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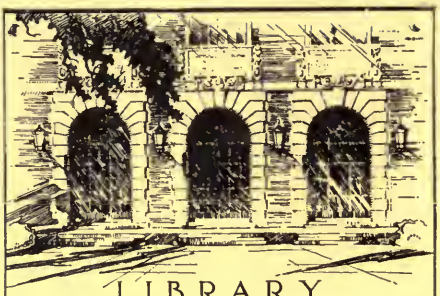

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MOSSES OF GUATEMALA

EDWIN B. BARTRAM

FIELDIANA: BOTANY
VOLUME 25
Published by
CHICAGO NATURAL HISTORY MUSEUM
JANUARY 31, 1949

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INTRODUCTION

In the course of three botanical expeditions to Guatemala, sponsored by Chicago Natural History Museum, Drs. Paul C. Standley and Julian A. Steyermark accumulated extensive collections of mosses from nearly every department. These collections have been beautifully supplemented by the later explorations of Dr. Aaron J. Sharp during 1945 and 1946 in the highlands of Guatemala, principally at altitudes between 1,250 and 3,500 meters, where the bryophyte flora is exceedingly rich and diversified.

It has been my privilege to study all of these collections and the results, supplemented by whatever other information I have been able to gather, are presented in the following pages. Although Dr. Sharp's collections have not been listed in full detail, all of his important discoveries, representing an addition of more than seventy species to the previously known flora, are included in the present work. As a result, the moss flora of Guatemala and its affinities are now far better known than those of any other Central American country.

As this is the first attempt at a realistic analysis of the mosses of any restricted tropical American country, the task is, to some extent, explorative. For, until many of the tropical American genera are disencumbered of numerous dubious species by careful revisional studies, the specific entities involved are open to a wide variety of interpretations.

Being astride the Cordilleran axis, extending from the Atlantic to the Pacific and possessing a highly diversified terrain, Guatemala should and does support a rich moss flora broadly representative of the American tropics. Since the literature relating to tropical American mosses is widely scattered and often difficult of access, it seems desirable to describe briefly, key out and illustrate the species known to occur in this limited area.

One of the more interesting problems involves the relationship of the Guatemalan flora with that of the surrounding and contributory regions. As might be logically expected, the Mexican types are abundantly represented. However, the most significant feature is

the occurrence of numerous species typical of the northern United States and Canada, including *Fissidens taxifolius, Ditrichum giganteum, Distichium capillaceum, Dicranella varia, Blindia acuta, Dicranum flagellare, Barbula reflexa, Barbula icmadophila, Tortella tortuosa, Grimmia apocarpa, Mnium serratum, Bryum cuspidatum, Meesea longiseta, Orthotrichum anomalum, Cratoneuron filicinum, Campylium stellatum, Campylium chrysophyllum, Hygrohypnum palustre, Drepanocladus aduncus, Brachythecium rutabulum, Eurhynchium pulchellum, Plagiothecium denticulatum, Hypnum cupressiforme, Rhytidium rugosum, Hylocomium brevirostre, Diphyscium foliosum* and many others of similar affinities. It is probable that this group is made up of species forced southward during glacial times. These species persisted in isolated communities in the highlands of Guatemala even after the retrograde migration had taken place. Many of these records mark the extreme southern limit of distribution of these species in North America.

Evidently the Cordillera served as a main highway of north-south migration. It is interesting, therefore, to record as immigrants from the opposite direction such typical Andean species as *Ditrichum gracile, Dicranella vaginata, Campylopus Jamesoni, Amphidium cyathicarpum, Holomitrium pulchellum, Hymenostomum Jamesoni, Streptopogon erythrodontus, Streptopogon rigidus, Entosthodon acidotus, Actinodontium megalocarpum, Eustichia Spruceana, Rhizogonium Lindigii, Eucatagonium politum* and *Pseudodimerodontium bolivianum,* all of which find their northern limits in Guatemala or adjacent Mexico.

A small group of tropical Brazilian mosses, comprising *Coleochaetium Standleyi, Philophyllum tenuifolium* and *Puiggariella aurifolia,* all three genera new to North America, suggests that in the past the tropical American flora may have been more closely integrated than it is now.

Among the well-known Caribbean species, found principally in the eastern lowlands, are *Sphagnum meridense, Fissidens pellucidus, Dicranella subinclinata, Syrrhopodon ligulatus, Syrrhopodon incompletus, Syrrhopodon lycopodioides, Calymperes lonchophyllum, Tortula mniifolia, Philonotis glaucescens, Micromitrium mucronifolium, Pseudocryphaea flagellifera, Jaegerinopsis squarrosa, Orthostichopsis tetragona, Pireella cymbifolia, Papillaria nigrescens, Meteoriopsis patula, Neckeropsis undulata, Neckeropsis disticha, Helicodontium capillare, Entodon macropodus, Sematophyllum caespitosum* and *Taxithelium planum.* Many of these species reach Florida on the north and range widely into northern South America in the opposite direction.

The following local mosses extend north through Mexico to Arizona and New Mexico: *Anoectangium arizonicum, Anoectangium obtusifolium, Merceya ligulata, Husnotiella revoluta, Symblepharis helicophylla, Dicranum rhabdocarpum, Tortula fragilis, Ptychomitrium Leibergii, Ptychomitrium serratum, Brachymenium mexicanum, Bryum truncorum, Orthotrichum Bartramii, Anacolia laevisphaera, Bartramia microstoma, Braunia secunda, Fabronia ciliaris, Fabronia Wrightii* and *Pleuropus Bonplandii.* A smaller group, comprising *Ditrichum ambiguum, Timmiella anomala, Barbula vinealis, Grimmia trichophylla, Orthodontium pellucens* and *Eurhynchium praelongum,* extends into California. Evidently with increasing distance from the Continental Divide, the number of species common to both areas decreases.

The Guatemalan moss flora may be roughly divided into three zones. The lowland mosses up to altitudes of about 1,500 meters are broadly representative of the Caribbean regions. Here such typical families as Fissidentaceae, Pterobryaceae, Meteoriaceae, Hookeriaceae and Sematophyllaceae are abundantly distributed. The second zone, representing the interior highlands from 1,500 or 2,000 meters up to 3,500 meters, supports a much more diversified and highly intriguing flora, including many surprising vagrants from far distant northern and southern latitudes. Such families as Dicranaceae, Pottiaceae, Bryaceae, Bartramiaceae and Orthotrichaceae are developed to an amazing extent. Pottiaceae alone account for 71 species distributed in 25 genera. The rocky summits of the higher mountains from 3,600 to 4,600 meters above sea level are truly alpine in character. Typical of these bleak, rugged domes are the following rupestrine species: *Andreaea rupestris, Distichium capillaceum, Encalypta vulgaris, Grimmia ovalis, Rhacomitrium crispulum* and *Hedwigidium imberbe.* In more sheltered places and a little below the bare rocks the upper fringes of the rich highland flora are encountered.

The strange mixtures present a puzzling problem in phytogeography, especially when two species of the same genus such as *Ditrichum giganteum* of northern United States and Yukon and *Ditrichum gracile* of the South American Andes are found growing in close proximity. It is hardly possible to appraise the full significance of these facts now, but the evidence surely indicates that Guatemala is one of the principal focal points of geographical distribution in tropical North America.

While probably far from complete, the total of approximately 519 species and 205 genera is broadly representative of the local

mosses and may cover at least 80 per cent of the actual flora. The percentage of endemic species is relatively small. Including the new species, approximately 58, or about 11 per cent of the total known flora, are not known outside of Guatemala. As the adjacent regions are more thoroughly explored, many of these endemics may prove to have a wider distribution than our present knowledge indicates.

No one can realize the shortcomings of the task in hand more keenly than I do. Yet I am hopeful that the work may prove useful to students of the local moss flora and in future investigations relating to Mexico and the other Central American countries.

The types of all new species are in the author's herbarium. A complete series of Standley's and Steyermark's collections, including duplicate types of the new species collected by them, can be found in the herbarium of Chicago Natural History Museum. The full series collected by Sharp is deposited in the herbarium of the University of Tennessee. As many species were collected in large quantities, a wide distribution of representative specimens will no doubt be made among the principal North American herbaria.

ORDER 1. SPHAGNALES

Typical peat mosses forming dense tufts or cushions in bogs or on wet mountain slopes. Stems elongate, pale green tinged with brown or red, without radicles, composed of a central core of lax cells enclosed in a woody cylinder and surrounded by one to several layers of large, hyaline cells. Branches in fascicles, crowded at tips of stems in dense heads. Branch leaves composed of two kinds of cells in one layer; a network of linear chlorophyllose cells in the meshes of which are large rhomboidal hyaline cells usually porose and reinforced by spiral fibers. Stem leaves similar in structure but dissimilar in shape. Capsules dark brown, subglobose, with a convex lid, on a short fleshy stalk or pseudopodium. Peristome lacking.

A very distinct order comprising a single genus, *Sphagnum*, of cosmopolitan distribution.

1. SPHAGNACEAE

1. SPHAGNUM Linn., Sp. Pl. 1106. 1753.

1. Cortical cells of stems and branches not fibrillose 2
   Cortical cells of stems and branches fibrillose 3

2. Chlorophyllose cells of branch leaves exposed on both surfaces, pigment brown ..... 4. *S. subsecundum*
   Chlorophyllose cells of branch leaves exposed on inner surface of leaf, pigment red ..... 3. *S. meridense*

3. Chlorophyllose cells of branch leaves central and included . . . 1. *S. magellanicum*
   Chlorophyllose cells of branch leaves exposed on inner surface of leaf ..... 2. *S. imbricatum*

1. SPHAGNUM MAGELLANICUM Brid., Musc. Rec. **2**, (1): 24. 1798.

Coarse plants tinged with brown. Cortical cells of stems and branches fibrillose. Stem leaves lingulate; branch leaves broadly ovate, deeply concave, chlorophyllose cells central and enclosed on both surfaces of leaf by the hyaline cells. (Fig. 1, A–C.)

Dept. Huehuetenango: *Steyermark 49918, 49921, 49922.*

Distribution: Labrador to Alaska south to Florida and California, Bermuda, Europe, Asia, South America.

Rare locally and confined to alpine regions.

2. SPHAGNUM IMBRICATUM Hornsch., Russow, Beitr. Torfm. 21. 1865.

Plants pale greenish brown. Cortical cells of stems and branches fibrillose. Stem leaves lingulate; branch leaves imbricated, ovate, chlorophyllose cells exposed on inner surface of leaf, lower hyaline cells ridged or fringed on inner walls where overlying the chlorophyllose cells. (Fig. 1, D–G.)

Dept. Huehuetenango: *Steyermark 49912.*

Distribution: Alaska, eastern North America south to Gulf States, Cuba, British Honduras, Europe, Asia.

Alpine meadow. Like the preceding, this species is known locally only from alpine regions. Dr. LeRoy Andrews informs me that he has a collection from British Honduras. The peculiar fringed fibrils on the inner walls of the hyaline leaf cells are a marked feature.

3. SPHAGNUM MERIDENSE (Hampe) C. M., Syn. **1**: 95. 1848.

Sphagnum acutifolium meridense Hampe, Linnaea **20**: 66. 1847.

Rather slender pale plants usually tinged with red. Stem leaves triangular-ovate, bordered, toothed at apex. Branch leaves laxly imbricated, oblong-ovate, concave, abruptly short pointed, apex involute, truncate, toothed. Chlorophyllose cells exposed on inner surface of leaf. (Fig. 1, H–J.)

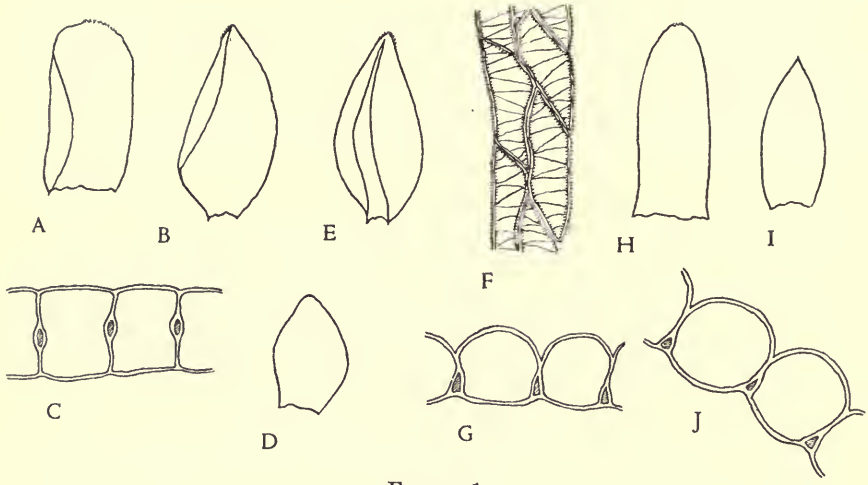

FIGURE 1

A–C, *Sphagnum magellanicum:* A, stem leaf, ×14; B, branch leaf, ×14; C, cross section of leaf cells, ×270.

D–G, *Sphagnum imbricatum:* D, stem leaf, ×14; E, branch leaf, ×14; F, basal cells of branch leaf, ×110; G, cross section of leaf cells, ×270.

H–J, *Sphagnum meridense:* H, stem leaf, ×14; I, branch leaf, ×14; J, cross section of leaf cells, ×270.

Dept. Alta Verapaz: *Standley 92577, 92590, 92620; Steyermark 43955.* Dept. Huehuetenango: *Steyermark 49746, 50183, 51898, 51950, 51951.* Dept. El Progresso: *Steyermark 43097, 43455.* Dept. Zacapa: *Steyermark 42631, 43203, 43257, 43287.* Dept. Chiquimula: *Steyermark 30989.* Dept. Jutiapa: *Steyermark 31935.*

Distribution: Florida, West Indies, Mexico, Central and South America.

By far the most frequent species of *Sphagnum* and apparently broadly distributed at altitudes above 1,200–1,500 meters. The characteristic ruddy tinge is usually a dependable indicator of this species.

4. SPHAGNUM SUBSECUNDUM Nees, Sturm, Deuts. Fl. Crypt. 17. 1819.

Rather robust, brittle plants, tinged with brown. Cortical cells of stem in one layer. Stem leaves lingulate, entire. Divergent branches cuspidate pointed, branch leaves broadly ovate, apex truncate, toothed; hyaline cells strongly fibrillose with numerous small pores on the dorsal face; chlorophyllose cells subrectangular in section, exposed on both surfaces of leaf. (Fig. 2, A–D.)

Dept. Huehuetenango: *Sharp 4968.* Dept. Baja Verapaz: *Sharp 5143.*

Distribution: Greenland and Labrador south to Gulf states and Mexico; California to Washington.

Wet rocks and swamp area at low to moderately high altitudes. These seem to be the first records of the species in Central America. The brown pigment, cortical cells of the stem in one layer and the chlorophyll cells exposed on both surfaces of the branch leaves are good diagnostic features.

ORDER 2. ANDREAEALES

Small dark colored, brittle rupestrial mosses of high altitudes. Stems slender, simple or branched. Leaves crowded, cells small, incrassate, in one layer; costa lacking or single. Capsules terminal, exserted on a short pseudopodium when ripe, without lid or peristome, splitting vertically into 4 (6–8) valves at maturity; columella persistent, spores smooth or papillose.

2. ANDREAEACEAE

One family and one genus only represented in North America.

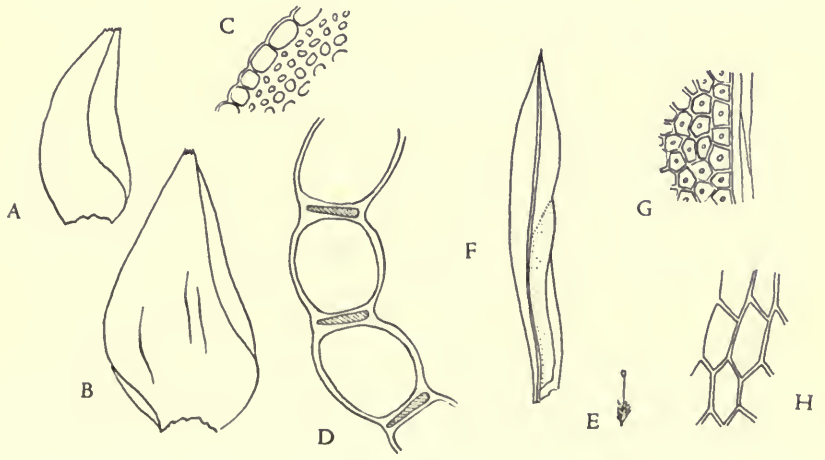

FIGURE 2

A–D, *Sphagnum subsecundum:* A, stem leaf, ×14, B, branch leaf, ×14; C, part of cross section of stem, ×110; D, cross section of leaf cells, ×270.

E–H, *Fissidens Svihlae:* E, plant, ×1; F, leaf, ×30; G, upper leaf cells and margin, ×270; H, cells of duplicate blade, ×270.

1. ANDREAEA Hedw., Sp. Musc. 47. 1801.

1. ANDREAEA RUPESTRIS Hedw., Sp. Musc. 47. 1801.

Brittle reddish brown plants in dense tufts or cushions. Stems 1–3 cm. long, simple or forked. Leaves crowded, imbricated when dry, ovate-lanceolate, concave, ecostate, muticous or slightly pointed, usually papillose on back, to 1.5 mm. long; cells incrassate, linear below, rounded-quadrate above. Capsules small, finally exserted on a short pseudopodium. (Fig. 3, A–D.)

Dept. San Marcos: *Steyermark 35542, 35546a, 35547, 35548a, 35549.* Dept. Solola: *Steyermark 47494.*

Distribution: Greenland to Alaska, south along mountains to Georgia and California, Europe, Tasmania, New Zealand, southern South America.

Exposed rock faces and crevices; locally confined to highest elevations, 3,800–4,600 m.

var. ALPESTRIS Thed., Bot. Not. 1849: **79.** 1849.

Differs from the typical form in the smaller, blunter leaves.

Dept. San Marcos: *Steyermark 35786, 36089.* Dept. Quezaltenango: *Steyermark 34209.*

Distribution: Greenland south to New York and Alaska south to Montana and Washington; also Europe.

ORDER 3. BRYALES

The great majority of mosses are comprised in this large order. Variable in detail, they seem to grow from a filamentose protonema. The spores and columella are developed from the endothecium. Capsules borne on a definite seta of variable length, indehiscent or opening by a lid; peristome present or lacking.

3. FISSIDENTACEAE

Small to medium sized plants with distichous, equitant leaves flattened in one plane, split to the costa on the inner side of the basal part into two blades clasping the stem. Lamina cells uniform, hexagonal or rounded, usually in one layer; costa ending in or below apex; seta terminal or lateral. Capsule erect or inclined; peristome simple, of 16 teeth, entire or split to or below middle into two subulate forks; spores small.

1. FISSIDENS Hedw., Sp. Musc. 152. 1801.

A large and very distinct group with the characters of the family.

I have profited largely by Dr. Grout's recent revision of the North American species of Fissidens (Grout **20**), which has clarified many problems in this intricate genus.

1. Leaves bordered entirely or in part with elongated cells 2
   Leaves not bordered with elongated cells 12

2. Leaves flaccid, cells large and lax 3
   Leaves firm, cells small and dense 5

3. Costa ending far below apex, capsules horizontal, asymmetrical ..... 3. *F. reticulosus*
   Costa longer, capsules suberect, symmetrical 4

4. Border distinct to apex ..... 1. *F. mollis*
   Border ending well below apex ..... 2. *F. dissitifolius*

5. Leaf cells unipapillate ..... 6. *F. Svihlae*
   Leaf cells smooth or pluripapillate 6

6. Dorsal blade of leaf long decurrent ..... 4. *F. longidecurrens*
   Dorsal blade not decurrent 7

7. Stem leaves unbordered, peristome teeth undivided ..... 10. *F. muriculatus*
   Stem leaves bordered in part, peristome teeth forked 8

8. Leaf cells papillose, dense and obscure 9
   Leaf cells smooth, distinct 11

9. Border weak, confined to basal part of duplicate blades ..... 7. *F. leptopodus*
   Border strong, extending to or beyond apex of duplicate blades 10

10. Apical and dorsal blades often variously bordered ..... 8. *F. Weiri*
    Apical and dorsal blades not bordered ..... 11. *F. elegans*

11. Border narrow, of one layer of cells ..... 5. *F. repandus*
    Border strong, bistratose ..... 9. *F. Steyermarkii*

12. Cells of leaf blade in 2 or more layers ..... 24. *F. grandifrons*
    Cells of leaf blade in one layer 13

13. Aquatic, slender floating plants ..... 25. *F. debilis*
    Not aquatic, plants tufted or gregarious 14

14. Marginal leaf cells incrassate, forming a definite border ..... 17. *F. austro-adiantoides*
    Marginal leaf cells not differentiated 15

15. Small plants, leaf margins crenulate 16
    Robust plants, leaf margins entire below, apex rounded 20

16. Leaf cells large, smooth, distinct ..... 12. *F. pellucidus*
    Leaf cells small, papillose or mammillose, obscure 17

17. Leaf cells pluripapillate, minute plants, leaves rounded ..... 16. *F. pusillissimus*
    Leaf cells unipapillate 18

18. Leaves subacute.....13. *F. Donnellii*
Leaves rounded or obtuse..... 19

19. Leaves less than 1 mm. long, ovate.....15. *F. Steerei*
Leaves 1–1.5 mm. long, oblong, abruptly contracted to an obtuse apex
14. *F. radicans*

20. Setae lateral..... 21
Setae terminal..... 23

21. Leaves subentire.....22. *F. polypodioides*
Leaf margins crenulate or serrate..... 22

22. Leaves acute, margins serrulate, costa excurrent.....21. *F. taxifolius*
Leaves obtuse, serrate near apex, costa percurrent.....23. *F. Oerstedianus*

23. Leaves broadly acute.....20. *F. similiretis*
Leaves broadly rounded..... 24

24. Leaves lingulate, apex rounded.....19. *F. lingulatus*
Leaves oblong-lingulate, apex obtuse.....18. *F. asplenioides*

1. FISSIDENS MOLLIS Mitt., Journ. Linn. Soc. **12**: 600. 1869.

Dioicous; stems 1–1.5 cm. long, often branched. Leaves strongly contorted when dry, flaccid and laxly spreading when moist, to 4 mm. long, linear-lanceolate, short acuminate, strongly bordered all around, border confluent at apex; costa ending below apex; cells

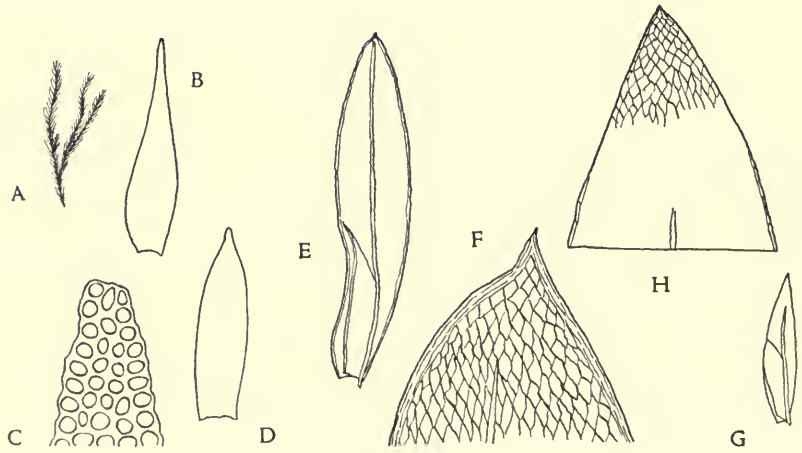

FIGURE 3

A–D, *Andreaea rupestris:* A, plant, ×1; B, leaf, ×20; C, apex of leaf, ×270; D, leaf of var. *rupestris*, ×20.

E–F, *Fissidens mollis:* E, leaf, ×14; F, apex of leaf, ×110.

G–H, *Fissidens dissitifolius:* G, leaf, ×14; H, apex of leaf, ×110.

lax, hexagonal, thin-walled, to 40 μ long above. Capsule small, inclined. (Fig. 3, E–F).

Dept. Izabal: *Steyermark 41781a.*

Distribution: Mexico, Costa Rica, West Indies, South America.

On damp rocks at low altitude. More robust than *F. dissitifolius* and distinguished at once by the leaf border continuous to the apex.

2. FISSIDENS DISSITIFOLIUS Sull., Proc. Am. Acad. **5**: 274. 1861.

Smaller than *F. mollis*. Stem less than 5 mm. long. Leaves oblong-ovate, short acuminate, about 1.5 mm. long, border narrow and indistinct, ending below apex about opposite tip of costa; costa ending above middle of apical blade; cells laxly hexagonal, to 25–30 μ long in the apical blade. Capsule small, inclined. (Fig. 3, G–H.)

Dept. Chiquimula: *Steyermark 30260.*

Distribution: Mexico, Cuba, Porto Rico.

On damp rocks at low altitude. Uncomfortably near the following species to which it is closely allied.

3. FISSIDENS RETICULOSUS (C.M.) Mitt., Journ. Linn. Soc. **12**: 603. 1869.

Conomitrium reticulosum C. M., Syn. **2**: 525. 1851.

Conomitrium hookeriaceum C. M., Bull. Herb. Boiss. **5**: 173. 1897.

Plants small, about 2 mm. high. Leaves 4–9 pairs, contorted when dry, larger upward, to 3 mm. long, lanceolate, acuminate, bordered to near apex; costa ending near middle of apical blade; cells lax, 35–40 μ long, 10–14 μ wide, thin-walled. Capsule nodding or horizontal, asymmetrical; urn less than 1 mm. long.

Distribution: Mexico, West Indies.

No Guatemalan collections have been seen but *C. hookeriaceum* C.M. is cited as a synonym of *F. reticulosus* (Grout **16**, p. 171). The shorter costa and asymmetrical capsules should distinguish it from *F. dissitifolius*.

4. FISSIDENS LONGIDECURRENS Thér., Smithson. Misc. Coll. **78**[2]: 10. 1926.

Slender, tufted, brownish yellow plants. Stems to 12–15 mm. long, laxly foliate. Leaves strongly crispate when dry, oblong-lanceolate, broadly acuminate, bordered all around, to 2 mm. long,

dorsal blade long decurrent; costa ending just below apex; cells irregularly hexagonal, 6–8 μ. Capsule small, suberect. (Fig. 4, A–B.)

Dept. Quezaltenango: *Standley 67470.*

Distribution: Mexico.

Shaded bank at high altitude. Readily identified by the long decurrent dorsal blade often extending nearly to the next leaf below.

5. FISSIDENS REPANDUS Wils., Kew Journ. Bot. **3**: 52. 1851.

Fissidens tortilis Hampe & C. M., Bot. Zeit. **22**: 340. 1864.

Fissidens Carionis C. M., Bull. Herb. Boiss. **5**: 171. 1897.

Fissidens fasciculato-bryoides C. M., Bull. Herb. Boiss. **5**: 172. 1897.

Small greenish yellow plants in lax colonies. Stems 6–8 mm. long. Leaves decurved and much crisped when dry, lanceolate, bordered all around, to 2 mm. long, short and broadly acuminate, dorsal lamina narrowed toward base; costa ending just below apex; cells small, rounded, hexagonal, 8–10 μ. Seta 6–7 mm. long; capsule horizontal to suberect; urn oblong, 1 mm. long. (Fig. 4, C–E.)

Dept. Alta Verapaz: *Standley 70469, 70473.* Dept. Huehuetenango: *Steyermark 50457.* Dept. Quezaltenango: *Steyermark 34086a, 34092a; Standley 85199.* Dept. Sacatepequez: *Standley 58650.* Dept. Zacapa: *Steyermark 29452.*

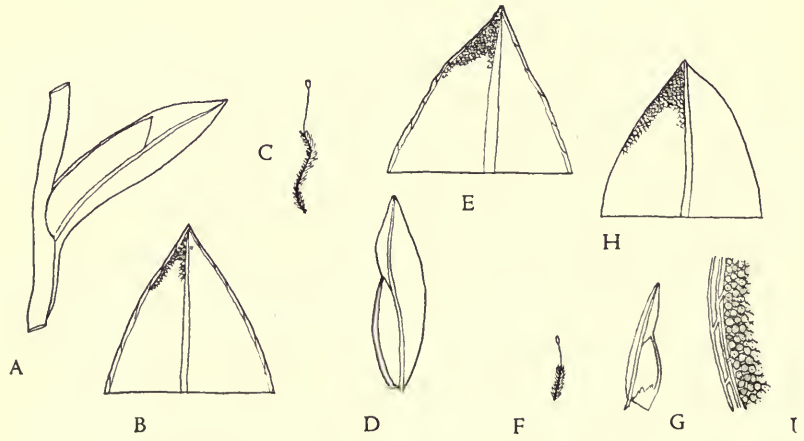

FIGURE 4

A–B, *Fissidens longidecurrens:* A, part of stem and leaf, ×14; B, apex of leaf, ×110.

C–E, *Fissidens repandus:* C, plant, ×1; D, leaf, ×14; E, apex of leaf, ×110.

F–I, *Fissidens leptopodus:* F, plant, ×1; G, leaf, ×14; H, apex of leaf, ×110; I, basal margin of duplicate blade, ×270.

Distribution: Florida, Mexico, West Indies, South America.

On soil, trees and walls at moderate altitudes. This seems to be a rather frequent species locally. The small size and strongly crisped leaves bordered throughout will serve to identify it easily.

6. FISSIDENS SVIHLAE Bartr., Bryol. **50**: 202. 1947.

Small, gregarious plants, yellowish green. Stems 1–2 mm. high. Leaves erect-spreading, slightly flexuous when dry, about 1.5 mm. long, narrowly lanceolate, entire, acuminate, bordered all around with a narrow cartilaginous band of linear cells; costa percurrent; upper leaf cells hexagonal, diam. 8–10 μ, strongly unipapillate, cells of duplicate blades lax, hyaline and smooth, to 40 or 50 μ long. Seta 5 mm. long; capsule erect, minute; peristome teeth deeply cleft. (Fig. 2, E–H.)

Dept. Suchiate: near Chicacoa, *Svihla 2871*.

Endemic.

Nearest *F. yucatanensis* Steere but leaf cells less than half as large. The papillae are about 5 μ high and are best seen in profile on the upper leaves which are slightly twisted when the plant is mounted entire. In many respects and especially the lax areolation of the duplicate blades this species closely resembles *F. Kegelianus* C. M. but the unipapillate leaf cells are at once distinctive.

7. FISSIDENS LEPTOPODUS Card., Rev. Bryol. **37**: 120. 1910.

Fissidens michoacanus Thér., Smithson. Misc. Coll. 78[2]: 12. 1926.

Small sordid green plants. Stems 2–3 mm. high. Leaves 5–20 pairs, 1–1.25 mm. long, oblong-lanceolate, acute; costa ending in or near apex; upper leaves indistinctly bordered toward base of duplicate blades with several elongated cells; margins crenulate; cells small, obscure, densely papillose. Capsule ovoid, suberect. (Fig. 4, F–I.)

Dept. Peten: *Bartlett 12155, 12485, 12545, 12553; Lundell 2100a.*

Distribution: Mexico, Trinidad.

On disintegrated limestone at low altitudes. *F. Garberi* L. & J. in which the border is confined to the perichaetial leaves should eventually be found in Guatemala but so far I have seen no collection that could be definitely referred to this species.

8. FISSIDENS WEIRI Mitt., Journ. Linn. Soc. **12**: 602. 1869.

Fissidens Howelli Bartr., Proc. Cal. Acad. Sci. IV. **21**: 78. 1933.

Small yellowish green plants, closely gregarious. Stems 4–5 mm. long with 6–9 pairs of leaves. Leaves erect-spreading, little altered when dry, about 2 mm. long, oblong-lanceolate, acute, border strong and pellucid below, distantly denticulate, ending far below apex of apical blade and often spurred on the inner side above; costa pellucid, ending just below apex; margins of apical blade minutely crenulate where unbordered; cells minute, very obscure, densely and minutely papillose. Seta terminal, 2–3.5 mm. long; capsule suberect, cylindrical, urn 1 mm. long. (Fig. 5, A–C.)

Dept. El Progresso: *Steyermark 43697.*

Distribution: West Indies, Galapagos Islands, Brazil.

On earth at high altitude. A plastic species but easily recognized by the variable leaf border, often lacking on the apical and dorsal blades but when well developed extending half way or more up the apical blade and frequently spurred on the inner edge.

9. FISSIDENS STEYERMARKII Bartr., No. Amer. Flora **15**^{3}: 177. 1943.

Dioicous. Rather robust, dull green terrestrial plants, densely gregarious. Stems to 1.5 cm. long and 3–4 mm. wide with leaves, sparsely radiculose below. Leaves in numerous pairs, the lower minute, gradually larger upward, the upper to 3.5 mm. long and 0.6 mm. wide, lightly contorted when dry, erect-spreading and often falcate when moist, oblong-lanceolate, short acuminate, bordered all around, the border strong, cartilaginous, bistratose and confluent with the percurrent costa at apex; cells distinct, hexagonal, with firm pellucid walls, 8–10 μ in diam., smooth or very faintly papillose. Seta terminal, solitary, about 8 mm. long; capsule inclined, urn 1 mm. long; lid short, conical, deep red; peristome teeth about 375 μ high, deeply bifid, the forks erect, coarsely and densely papillose; spores pale, papillose, diam. 10–18 μ. (Fig. 5, D–F.)

Dept. San Marcos: *Steyermark 36576* TYPE. Dept. Quezaltenango: *Steyermark 33889.* Dept. Suchitepequez: *Steyermark 35310.*

Endemic. On moist rocks and slopes at medium to high altitudes.

Although evidently near *F. plurisetus* Bartr. of Panama the distinctions are sharply defined and well maintained. In *F. Steyermarkii* the setae are constantly solitary in all three collections representing over a hundred fruiting plants; in all parts these plants

are about twice the size of *F. plurisetus* and the leaf cells by contrast are distinct and smooth or very faintly papillose.

10. FISSIDENS MURICULATUS Spruce, Journ. Linn. Soc. **12**: 593. 1869.

Small slender plants with numerous pairs of leaves. Stems 4–5 mm. long. Leaves curved when dry, 1–1.5 mm. long, oblong, broadly acute, not bordered, dorsal blade ending in a rounded lobe at base; margins crenulate all around; costa nearly percurrent; cells obscure, 6–8 μ, rather bluntly papillose. Perichaetial leaves indistinctly bordered at base of duplicate blades; seta terminal, 1.5 mm. long; capsules suberect, peristome teeth entire. (Fig. 5, G–J.)

Dept. Sacatepequez: *Standley 88961a.*

Distribution: West Indies, Brazil.

On tree at moderate altitude. The undivided peristome teeth and faintly bordered perichaetial leaves are clearly diagnostic. Dr. Grout has confirmed the determination with the comment that the papillae of the leaf cells are shorter and blunter than in the type. If *Moenkemeyera* is recognized as a valid genus this species would belong there.

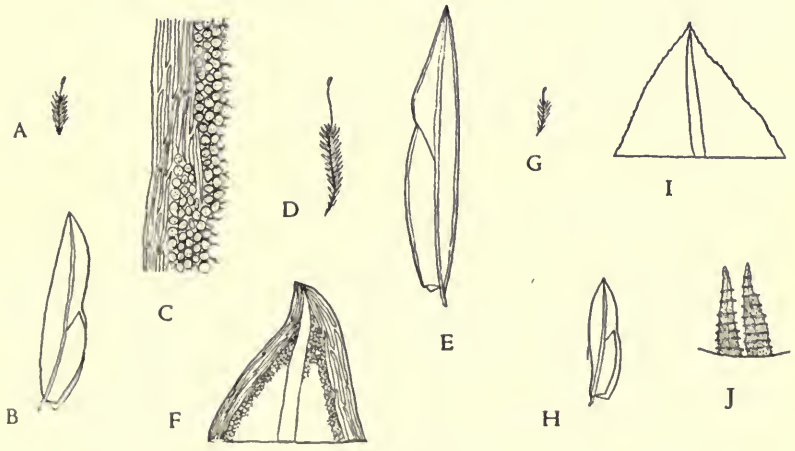

FIGURE 5

A–C, *Fissidens Weiri:* A, plant, ×1; B, leaf, ×14; C, part of margin of apical blade, ×270.

D–F, *Fissidens Steyermarkii:* D, plant, ×1; E, leaf, ×14; F, apex of leaf, ×110.

G–J, *Fissidens muriculatus:* G, plant, ×1; H, leaf, ×14; I, apex of leaf, ×110; J, part of peristome, ×110.

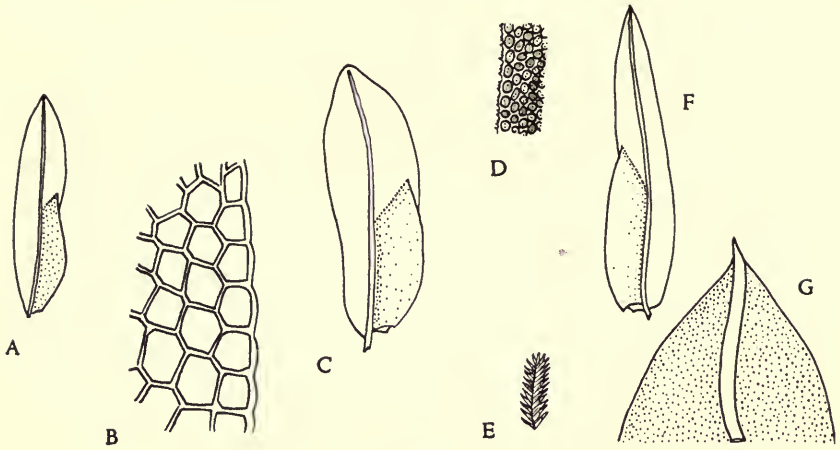

FIGURE 6

A–B, *Fissidens pellucidus:* A, leaf, ×30; B, upper leaf cells and margin, ×320.
C–D, *Fissidens pusillissimus:* C, leaf, ×68; D, upper leaf cells and margin, ×270.
E–G, *Fissidens taxifolius:* E, plant, ×1; F, leaf, ×20; G, apex of leaf, ×110.

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11. FISSIDENS ELEGANS Brid., Bryol. Univ. **2**: 691. 1827.

Small dull green plants, laxly gregarious. Stems 4–5 mm. long. Leaves numerous, curved with deflexed points when dry, oblong-lanceolate, acute, about 1 mm. long, strongly bordered on the duplicate blades only; margins of apical and dorsal blades minutely crenulate; costa pellucid, percurrent; cells minute, about 5 μ, obscure, papillose. Seta terminal, about 4 mm. long; capsule suberect. (Fig. 7, A–D.)

Dept. Quezaltenango: *Standley 86644* (distributed as *F. radicans*).

Distribution: Mexico, West Indies, South America.

On wet rock at moderate altitude. The strongly bordered duplicate blades and unbordered apical and dorsal blades distinguish this species from any of its local allies.

12. FISSIDENS PELLUCIDUS Hornsch., Linnaea **15**: 146. 1841.

F. subcrenatus Schp., in C. M. Syn. **2**: 531. 1851.
F. rufulus Sull., Proc. Am. Acad. **5**: 275. 1861.
F. Wrightii Jaeg., Enum. Fissid. 12. 1869.

Small gregarious plants, green tinged with reddish brown. Stems about 5 mm. long, with 8 or 10 pairs of leaves, 1.5 mm. wide with

leaves. Leaves slightly curved when dry, well spaced, not overlapping, 1 mm. long, oblong-ovate, bluntly acute, unbordered, dorsal blade ending abruptly at base of costa; margins crenulate; costa strong, brownish, ending below apex; leaf cells hexagonal, smooth, large and pellucid, to 15 μ in diam. Seta slender, 3 mm. long; capsule small, ovoid, erect. (Fig. 6, A–B.)

Dept. Baja Verapaz: *Sharp 5181.*

Distribution: Georgia, Mexico, West Indies to Brazil.

Moist bank at moderate altitude. The small size, unbordered leaves with relatively large, smooth, pellucid cells are distinctive as compared with all the other Guatemalan species.

13. Fissidens Donnellii Aust., Bot. Gaz. **4**: 151. 1879.

Autoicous; minute plants. Stems short. Leaves numerous, narrowly oblong, usually broadly subacute, unbordered, crenulate all around; costa ending 3–5 cells below apex; cells unipapillate. Seta terminal, 2–4 mm. long; capsule small, erect. (Fig. 7, E–F.)

Dept. Alta Verapaz: *Steyermark 44086, 44957, 44968.* Dept. Quezaltenango: *Standley 84317.*

Distribution: Florida, Mexico, West Indies.

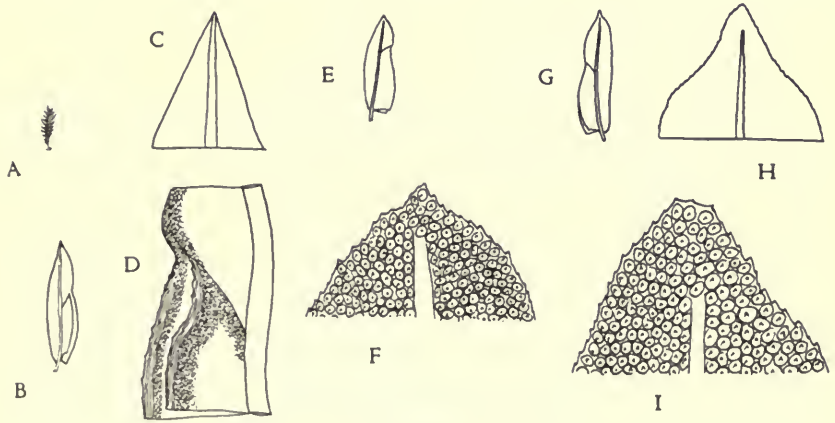

Figure 7

A–D, *Fissidens elegans:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×110; D, apex of duplicate blades, ×110.

E–F, *Fissidens Donnellii:* E, leaf, ×14; F, apex of leaf, ×270.

G–I, *Fissidens radicans:* G, leaf, ×14; H, apex of leaf, ×110; I, apex of leaf, ×270.

On wet banks and calcareous rocks at medium to high altitudes. The toothed margin of the duplicate blades may be a distinctive feature of this species.

14. FISSIDENS RADICANS Mont., Ann. Sci. Nat. **11**, 14: 345. 1840.

Slightly larger than *F. Donnellii*. Stems often innovating. Leaves oblong, 1–1.5 mm. long, scarcely tapering above until just below apex where the blade is contracted to a short, obtuse point; costa ending below apex; margins of duplicate blades finely crenulate and similar to apical margins.

Dept. Peten: *Lundell 3337* in part. (Fig. 7, G–I.)

Distribution: Florida, Mexico, Panama, Porto Rico, British and French Guiana.

A lowland species. The larger size and different shaped leaves will help to distinguish this species from *F. Donnellii*.

15. FISSIDENS STEEREI Grout, No. Amer. Flora **15**[3]: 191. 1943.

Minute plants similar to *F. Donnellii*. Leaves less than 1 mm. long, broadly ovate, rounded at apex, unbordered, crenulate-serrate all around; costa ending 5–8 cells below apex; cells hexagonal, 8–10 μ, coarsely unipapillate, the marginal row somewhat transversely elongate and pellucid. Sporophyte unknown. (Fig. 8, A–C.)

Dept. Jalapa: *Steyermark 32913*.

Distribution: Porto Rico.

Base of waterfall at medium altitude. The relatively broader, shorter leaves, rounded at apex and with the costa ending slightly lower will distinguish this species from *F. Donnellii*.

16. FISSIDENS PUSILLISSIMUS Steere, Ann. Bryol. **10**: 116. 1938.

Minute, laxly gregarious plants, yellowish green. Stems less than 2 mm. long and less than 1 mm. wide with leaves. Leaves in 4 to 6 pairs, 0.3–0.5 mm. long, oblong, obtusely rounded, unbordered; costa strong, brownish, ending well below apex; margins papillose-crenulate all around; dorsal blade ending at leaf insertion or in the reduced lower leaves ending some distance above base of costa; cells strongly pluripapillose and obscure. (Fig. 6, C–D.)

Dept. Peten: *Lundell 2948*.

Distribution: British Honduras.

Bark of tree at low altitude. A rare lowland species so small and inconspicuous that it is likely to be collected only by chance. The obscure pluripapillose leaf cells should distinguish this species from its near allies in the Crenularia Section without much trouble.

17. FISSIDENS AUSTRO-ADIANTOIDES C. M., Bull. Herb. Boiss. **5**: 547. 1897.

Fissidens incrassatolimbatus Card., Rev. Bryol. **37**: 119. 1910.

Robust plants, 6–7 cm. high, branched. Stems to 8 mm. wide with leaves, densely foliate. Leaves flexuous with contorted points when dry 5–6 mm. long, 1 mm. wide, oblong-lanceolate, short acuminate, bordered all around with a distinct band of incrassate cells in 4–5 rows and in 2 layers in spots; margins coarsely and irregularly toothed toward apex; costa percurrent; cells 12–15 μ in diam., irregularly rounded, with thick, pellucid walls. Sporophyte not seen. (Fig. 8, D–E.)

Dept. Alta Verapaz: *Turckheim 7722* (as *F. incrassatolimbatus* Card.); *Standley 71604, 89819.* Dept. Huehuetenango: *Steyermark 48865, 48575, 48866a.*

Distribution: Jamaica.

On rocks and trees at medium altitudes. I have a single plant from the type collection of *F. incrassatolimbatus* Card. (*Turckheim*

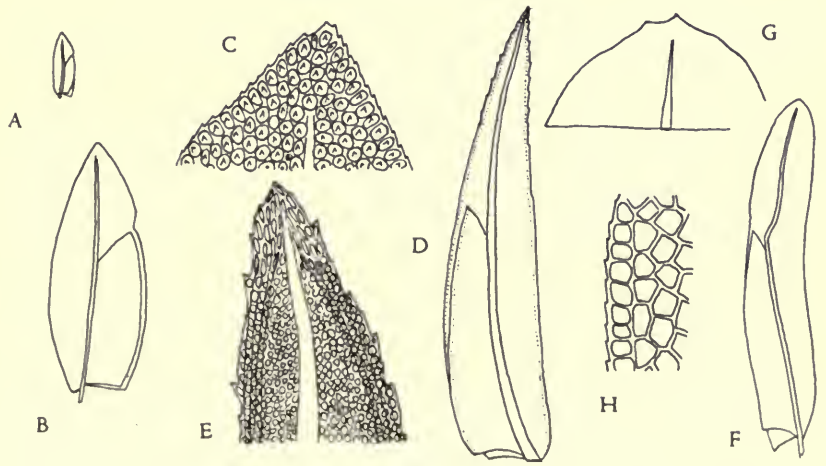

FIGURE 8

A–C, *Fissidens Steerei:* A, leaf, ×14; B, leaf, ×54; C, apex of leaf, ×270.
D–E, *Fissidens austro-adiantoides:* D, leaf, ×14; E, apex of leaf, ×110.
F–H, *Fissidens asplenioides:* F, leaf, ×14; G, apex of leaf, ×110; H, upper leaf cells and margin, ×270.

7722) which seems to be inseparable from the collections cited above which Dr. Grout has referred to *F. austro-adiantoides* C. M. In all of these collections the border is bistratose in spots here and there but never continuously. The apical teeth are irregular and vary considerably on the same plant. I have not seen any authentic material of *F. Bourgaeanus* Besch., but the distinctions seem rather vague and I should not be surprised if eventually both *F. austro-adiantoides* and *F. incrassatolimbatus* will have to be included in *F. Bourgaeanus.*

18. FISSIDENS ASPLENIOIDES Hedw. Sp. Musc. 156. 1801.

Rather robust yellowish green plants growing in dense colonies. Stems usually simple, 1.5–5 cm. long, densely foliate. Leaves erect-spreading with strongly circinate tips when dry, about 3 mm. long, 0.5 mm. wide, ligulate, unbordered, obtusely rounded at apex; margins minutely crenulate all around; costa ending well below apex; cells irregularly hexagonal, dense, not incrassate, 8–10 μ. Seta terminal, 4–6 mm. long; capsule oblong, inclined. (Fig. 8, F–H.)

Dept. Alta Verapaz: *Standley 69651, 70502, 71151.* Dept. San Marcos: *Steyermark 35988, 36010, 36488, 36494, 36647; Standley 68483, 86458.* Dept. Totonicapan: *Standley 65942.* Dept. Quezaltenango: *Standley 65328, 83267, 83279, 83504, 83685, 84607, 85121, 85529, 85939, 85667, 85951, 85998; Steyermark 34723, 35111, 35139, 35153.* Dept. Suchitepequez: *Steyermark 46852.* Dept. Sacatepequez: *Standley 58957.* Dept. Solola: *Standley 62350, 62749.* Dept. Chimaltenango: *Standley 61529, 62013, 79906.* Dept. Zacapa: *Steyermark 42221, 42672, 43204.* Dept. Chiquimula: *Steyermark 30922.*

Distribution: Wide in tropical regions throughout the world.

On damp banks, rocks and trees at medium to high altitudes. Easily recognized by the slender fronds with the leaf points neatly coiled backwards when dry. It is often richly colored and is by far the commonest species of the genus throughout Central America.

19. FISSIDENS LINGULATUS C. M., Bull. Herb. Boiss. **5**: 172. 1897.

?*Fissidens gracilifrondeus* C. M., Bull. Herb. Boiss. 5: 172. 1897.

Moderately large plants. Stems to 1.5 cm. long. Leaves to 20 pairs, broadly rounded and slightly crenulate at apex, about 2 mm. long; costa ending below apex; duplicate blades to ¾ the length of the leaf; cells rounded, 7–10 μ, mammillose, smaller toward margins. (Fig. 9, A–B.)

Cuesta de Atitlan: *Bernoulli & Cario 115.*

Distribution: Mexico.

The only plants I have seen are from Mexico and these seem to differ from *F. asplenioides* in the broader leaves with the apices uniformly rounded without any suggestion of an apiculus. The duplicate blades are also relatively longer but the distinctions are neither sharp nor very convincing.

20. FISSIDENS SIMILIRETIS Sull. var. GUADALUPENSIS (Schimp.) Grout, No. Amer. Flora **15**[3]: 193. 1943.

Very similar in every way to *F. asplenioides* except that the leaf apex is broadly acute instead of obtusely rounded. (Fig. 9, C–D.)

Dept. San Marcos: *Steyermark 35704, 36492* (both distrib. as *F. asplenioides*).

Distribution: With the species, West Indies.

On shaded banks at high altitudes. The distinctions between these plants and *F. asplenioides* are slight. In fact the series of *F. asplenioides* from Guatemala shows considerable variation in the form of the leaf apex from broadly rounded to obtuse and minutely apiculate so that both *F. lingulatus* and *F. similiretis guadalupensis* as represented here might be included in the form circle of *F. asplenioides* without much violence to conservative judgment.

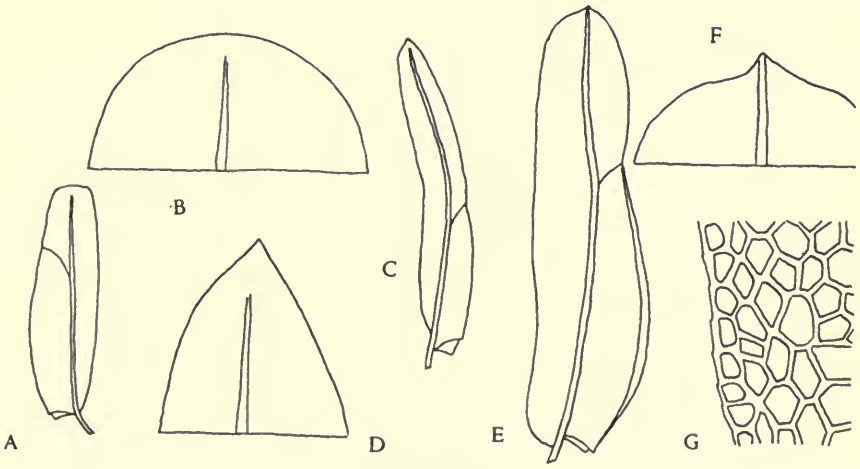

FIGURE 9

A–B, *Fissidens lingulatus:* A, leaf, ×14; B, apex of leaf, ×110.

C–D, *Fissidens similiretis* var. *guadalupensis:* C, leaf, ×14; D, apex of leaf, ×110.

E–G, *Fissidens polypodioides:* E, leaf, ×14; F, apex of leaf, ×54; G, upper leaf cells and margin, ×270.

21. FISSIDENS TAXIFOLIUS Hedw., Sp. Musc. 155. 1801.

Medium sized plants, laxly gregarious, dark green. Stems 6–7 mm. high, about 3 mm. wide with leaves. Leaves numerous, crowded, with strongly circinate tips when dry, widely spreading when moist, 2 mm. long, oblong-lanceolate, acute or short acuminate, unbordered; margins serrulate all around; costa pale, short excurrent; cells small, dense, opaque, rounded-hexagonal, diam. 8–10 μ, convex on free surfaces, one or two rows at margins paler but not forming a distinct border. Setae lateral from near base of stem, to 15 mm. long; capsule inclined, asymmetrical, peristome teeth bright red. (Fig. 6, E–G.)

Dept. Alta Verapaz: *Sharp 2987*. Dept. Baja Verapaz: *Sharp 2860*.

Distribution: Canada and eastern United States south to Florida, Missouri and Arizona.

Shaded banks and slopes at moderate altitudes. Here the leaves are more sharply pointed than in most of the United States collections but otherwise the agreement is close. This is a significant discovery in line with the occurrence of so many north temperate types in the highlands of Guatemala. The species has not been recorded before in North America south of the Mexican border.

22. FISSIDENS POLYPODIOIDES Hedw., Sp. Musc. 154. 1801.

Dioicous; robust, frondose yellowish green plants. Stems simple or sparingly branched, 2–8 cm. long, 5–7 mm. wide. Leaves numerous, not crowded, curved at tips when dry, oblong-lingulate, abruptly rounded and bluntly apiculate, entire, not bordered, 4–5 mm. long, 1 mm. wide above; costa percurrent; cells hexagonal, to 20 μ long, smaller toward margins. Setae lateral, about 1 cm. long; capsule inclined, narrowly pyriform. (Fig. 9, E–G.)

Dept. Huehuetenango: *Steyermark 49748*. Dept. San Marcos: *Steyermark 37261*. Dept. Zacapa: *Steyermark 29962, 42658, 43306*. Dept. Chiquimula: *Steyermark 31020*.

Distribution: Southeastern United States, Mexico, West Indies, Central and South America.

On damp banks, rocks and trees at medium to high altitudes. Although the apical margins are usually repand and the apex varies considerably in outline the teeth are not quite as sharp and pronounced as in *F. Oerstedianus*.

23. FISSIDENS OERSTEDIANUS C. M., Syn. **2**: 529. 1851.

Slightly more robust than the preceding species, fronds 8–10 mm. wide. Leaves serrate near apex with sharp, irregular teeth. Capsule horizontal, subcylindric. (Fig. 10, A–B.)

Dept. Zacapa: *Steyermark 43318.*

Distribution: Costa Rica, Panama.

On moist banks at high altitude. The distinctions between this species and *F. polypodioides* are not always as clear as they might be and I am doubtful if they can be specifically separated.

24. FISSIDENS GRANDIFRONS Brid., Musc. Rec. Suppl. **1**: 170. 1806.

Dull brownish green plants in dense mats. Stems 2–4 cm. long or longer, rigid, often branched below, densely foliate, fronds 2–3 mm. wide. Leaves rigidly erect-spreading, about 3 mm. long, unbordered, linear-lanceolate, bluntly acute, entire, opaque; costa ending in apex; cells hexagonal, incrassate, in 2 or more layers except at margins. Setae lateral, capsules erect, fruit rare. (Fig. 10, C–D.)

Dept. Huehuetenango: *Steyermark 50004, 50005.* Dept. San Marcos: *Steyermark 36897.*

Distribution: Southern Canada, United States, Mexico, Europe, Asia.

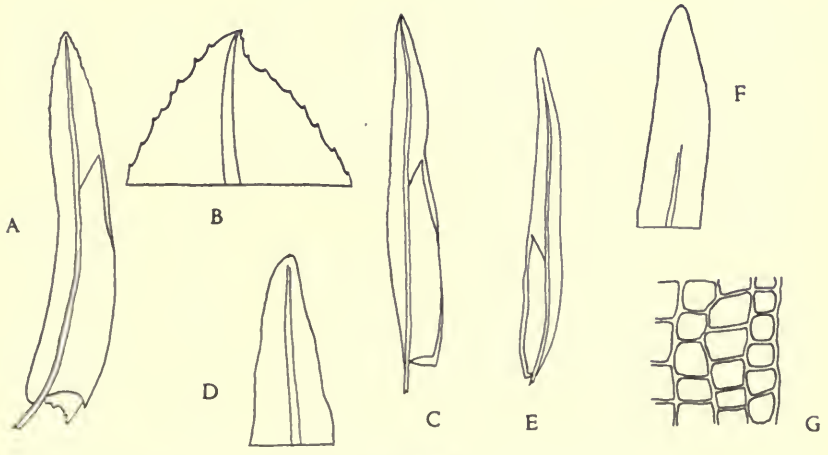

FIGURE 10

A–B, *Fissidens Oerstedianus:* A, leaf, ×8; B, apex of leaf, ×54.
C–D, *Fissidens grandifrons:* C, leaf, ×14; D, apex of leaf, ×54.
E–G, *Fissidens debilis:* E, leaf, ×8; F, apex of leaf, ×54; G, upper leaf cells, ×270.

On wet rocks or submerged in streams in calcareous regions at high altitudes. These collections seem to represent the southern limit of distribution in North America.

25. FISSIDENS DEBILIS Schwaegr., Suppl. 1[2]: 11. 1816.

Fissidens julianus Schimp., Flora 21: 271. 1838.
Conomitrium Turckheimi C. M., Bull. Herb. Boiss. 5: 173. 1897.

Slender floating plants, yellowish at tips, dark brown below. Stems branching, 3 cm. long or often much longer. Leaves distant, spreading, flexuous when dry, to 5–6 mm. long, linear-lanceolate, bluntly acute; costa ending well below apex; cells irregularly hexagonal, to 25 μ long, smaller toward margins. Fruit rare, terminal on short lateral branches, seta shorter than capsule. (Fig. 10, E–G.)

Dept. Jutiapa: *Standley 75512*.

Distribution: United States, Mexico, South America, Europe, Africa.

On rocks in stream at moderate altitude. This sterile collection is one of the smaller forms with stems only 2–3 cm. long. Muller also cites two collections from Alta Verapaz.

4. DITRICHACEAE

Slender densely caespitose plants. Stems erect, sparingly branched. Leaves narrowly lanceolate, entire or slightly toothed near apex; costa percurrent; cells smooth, not differentiated at basal angles. Seta erect; capsules erect or nodding; peristome simple, of 16 slender teeth, entire or split nearly to base into 2 filiform forks; lid conical or beaked; annulus broad; spores small.

1. Capsules immersed, peristome lacking.....1. *Bryomanginia*
   Capsules exserted, peristome present..... 2
2. Leaves 2 ranked, peristome teeth obliquely striolate.....2. *Distichium*
   Leaves not 2 ranked, peristome teeth papillose..... 3
3. Upper leaf cells elongate, capsules smooth.....4. *Ditrichum*
   Upper leaf cells quadrate, capsule furrowed when dry.....3. *Ceratodon*

1. BRYOMANGINIA Thér., Rec. de Trav. Crypt. 1. 1931.

Small, densely tufted alpine plants. Leaves linear, concave, obtuse, entire; costa faint, short; cells oval, smooth, elongate below. Seta short; capsule small, ovoid, immersed; peristome lacking; annulus large; lid convex.

1. BRYOMANGINIA SAINT PIERREI Thér., Rec. de Trav. Crypt. 2. 1931.

Autoicous; small, brittle, reddish brown plants growing in dense, compact cushions. Stems erect, to 1.5 cm. high. Leaves erect, 1.5 mm. long, linear, deeply concave, obtuse; margins erect, entire; costa about 50 μ wide below, narrower upward, poorly defined, ending near or above mid-leaf; upper cells oval, incrassate, smooth, oblique, to 15 μ long, 6–8 μ wide, inner basal cells rectangular, pellucid, 12–15 μ wide, to 75 μ long, narrower toward margins. Capsule ovoid, smooth, 0.5–0.6 mm. long, immersed or emergent, on a short, fleshy seta about 0.5 mm. long; peristome none; annulus large and persistent, about 65 μ high, of 2–3 rows of cells; lid convex, mammillate; spores pale brown, minutely papillose, diam. 25 μ. (Fig. 11, A–E.)

Dept. San Marcos: *Sharp 5423*.

Distribution: Mexico.

Non-calcareous boulder near summit of Volcan Tajumulco. A rare, alpine species previously known only from the type locality on Nevada de Toluca, Mexico. Superficially the plants are suggestive of *Andreaea* but the structural details are of course distinctive.

2. DISTICHIUM Bry. Eur. fasc. **29–30.** 1846.

Slender, silky plants in dense tufts. Stems dichotomously branched, densely tomentose below. Leaves distichous, abruptly

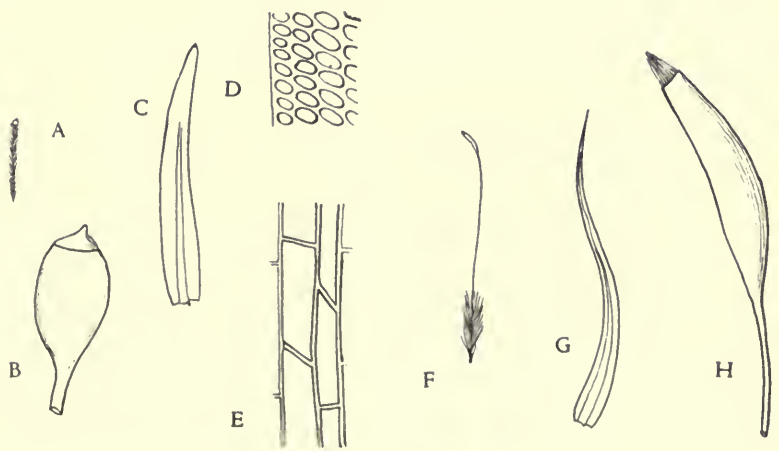

FIGURE 11

A–E, *Bryomanginia Saint Pierrei:* A, plant, ×1; B, capsule, ×20; C, leaf, ×20; D, upper leaf cells and margin, ×270; E, basal leaf cells, ×270.

F–H, *Ditrichum rufescens:* F, plant, ×1; G, leaf, ×12; H, capsule, ×10.

narrowed to a spreading, subulate point from an oblong, sheathing base; costa long excurrent. Seta elongate; capsule suberect; peristome teeth irregularly divided.

1. DISTICHIUM CAPILLACEUM (Hedw.) Bry. Eur. fasc. **29–30.** 1846.

Cynontodium capillaceum Hedw., Sp. Musc. 57. 1801.

Plants densely tufted or mixed with other mosses. Stems to 3 cm. or more high. Leaves 4–5 mm. long, in 2 ranks, the slender, spreading, coarsely papillose point longer than the erect, clasping base. Costa long excurrent; basal cells linear, gradually becoming subquadrate above shoulders. Seta slender, to 2 cm. long; capsule erect, oblong-cylindric; peristome teeth 16, obliquely striolate. (Fig. 12, A–C.)

Dept. Huehuetenango: *Standley 81627, 81672, 83090a.*

Distribution: Cosmopolitan in temperate, arctic and antarctic regions and at high altitudes in the tropics.

On rocks in alpine regions. The widely spreading, papillose leaf points readily separate this species from any of the local species of *Ditrichum.*

3. CERATODON Brid., Bryol. Univ. **1:** 480. 1826.

Plants densely tufted. Stems erect, closely foliate. Leaves ovate-lanceolate, contorted when dry; margins recurved; costa short excurrent; cells smooth, subquadrate, elongate below. Seta erect, elongate; capsule suberect; peristome teeth split nearly to base.

1. CERATODON STENOCARPUS Bry. Eur. fasc. **29–30.** 1846.

Ceratodon vulcanicus C. M., Bull. Herb. Boiss. **5:** 191. 1897.

Tufts yellowish above, brown below. Stems to 2 cm. or more long. Leaves crowded, curved and contorted when dry, 1.5–2 mm. long, ovate-lanceolate, acuminate; margins recurved nearly to apex, coarsely toothed near tip; costa subpercurrent; upper cells quadrate, incrassate, basal cells rectangular. Seta about 2 cm. long, pale yellow; capsules suberect or often arcuate and inclined, brown, urn 2 mm. long, sulcate when dry; peristome teeth brown, sharply papillose, divided nearly to base. (Fig. 12, D–F.)

Dept. Huehuetenango: *Standley 83092.* Dept. San Marcos: *Steyermark 35787, 36118.* Dept. Totonicapan: *Standley 62699a, 84463, 84551.* Dept. Quezaltenango: *Steyermark 34212, 34625; Standley 67620, 85751a, 85752.* Dept. Chimaltenango: *Standley 61909, 80602.*

Distribution: Southern Arizona, Mexico, south along Andes to Bolivia, also southern Europe, tropical Asia, Africa.

On ledges, rocks and dry banks at high altitudes. These collections are uniformly different from the cosmopolitan *C. purpureus* in the pale setae and more erect, paler capsules. Occasionally a capsule will be nearly horizontal but the great majority are only slightly inclined to suberect.

4. DITRICHUM (Timm.) Hampe, Flora **50**: 181. 1867.

Small tufted plants. Stems erect. Leaves narrowly lanceolate, subulate-acuminate; costa strong; upper cells linear or oval, basal cells rectangular, alar cells not differentiated. Seta slender, elongate; capsules erect or slightly curved; peristome teeth 16, papillose, divided to base or cleft above.

1. Leaf base oblong, abruptly narrowed at shoulders ..... 1. *D. gracile*
   Leaf base ovate, gradually narrowed upward 2
2. Stems 5–10 cm. long 3
   Stems 2–3.5 cm. long 4
3. Leaves 5–8 mm. long ..... 3. *D. giganteum*
   Leaves 3–4 mm. long ..... 2. *D. longicaule*

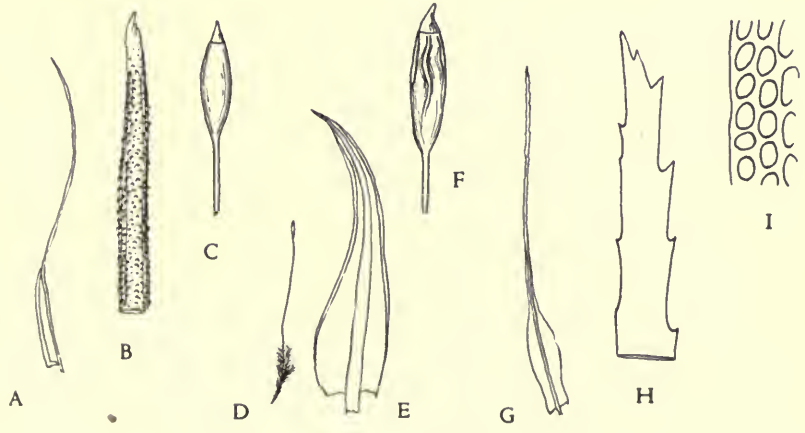

FIGURE 12

A–C, *Distichium capillaceum:* A, leaf, ×8; B, apex of leaf, ×110; C, capsule, ×8.

D–F, *Ceratodon stenocarpus:* D, plant, ×1; E, leaf, ×20; F, capsule, ×8.

G–I, *Ditrichum gracile:* G, leaf, ×8; H, apex of leaf, ×110; I, upper leaf cells and margin, ×270.

4. Seta 5 mm. long, peristome teeth irregularly cleft, not bifid . . . 4. *D. Steyermarkii*
Seta 1–2 cm. long, peristome teeth split to base . . . 5

5. Dioicous, seta to 1 cm. long . . . 5. *D. ambiguum*
Paroicous, seta to 2 cm. long . . . 6. *D. rufescens*

1. DITRICHUM GRACILE (Mitt.) Par., Ind. Bryol. ed. **1**: 393. 1895.

Cynontodium gracile Mitt., Jour. Linn. Soc. **12**: 43. 1869.

Dioicous; slender, glossy, tawny plants. Stems 2–4 cm. long. Leaves erect with points often spirally twisted when dry, to 4 mm. long, abruptly linear-subulate from an oblong, clasping base, toothed at extreme apex; costa long excurrent; basal cells linear, incrassate, often very narrow and hyaline toward margins, quickly shorter toward leaf shoulders, irregularly oval above. Seta about 12 mm. long; capsule suberect. (Fig. 12, G–I.)

Dept. Solola: *Steyermark 47497, 47503.*

Distribution: Mexico, Ecuador.

On exposed rocky summit of Volcan Atitlan. The spiral twisting of the leaf points is quite obvious. Several species of the southern hemisphere show the same character but it is not shared by any other North American species I know of.

2. DITRICHUM LONGICAULE Bartr., Bryol. **49**: 109. 1946.

Tall, slender plants in yellowish green tufts. Stems to 10 cm. long, sparsely radiculose below. Leaves suberect, to 4.25 mm. long, not crowded, curved and flexuous when dry, rather quickly contracted from an oblong-ovate, concave base to a long, narrowly linear subula, flat above and coarsely toothed at apex; margins erect; costa broad below, long excurrent; basal cells linear with thickened, pellucid walls, much shorter and irregularly oval above. Sporophyte unknown. (Fig. 13, A–C.)

Dept. San Marcos: Between San Sebastian and summit of Volcan Tajumulco, alt. 3,800–4,600 m., *Steyermark 35514*, TYPE.

Similar in general appearance to robust forms of *D. flexicaule* but distinct in the flat, linear leaf subula which is coarsely toothed at and near the extreme apex. *D. crinale* (Tayl.) Par. of Ecuador has longer leaves (6–7 mm.) with longer, finer, setaceous points.

3. DITRICHUM GIGANTEUM Williams, Bull. N. Y. Bot. Gard. **2**: 113. 1901.

Dioicous; plants in deep, dense tufts, yellowish green above, brown below. Stems branched, 10 cm. or more long. Leaves

laxly spreading, often falcate, to 7–8 mm. long, narrowly lanceolate, gradually long acuminate, slightly toothed near apex; costa long excurrent; basal cells linear with thick, pitted walls, upper cells oval. (Fig. 13, D–F.)

Dept. Huehuetenango: *Standley 83085, 83086, 83087, 83090c, 83091a.*

Distribution: Alaska, northern United States.

In shade of juniperus forest at high altitudes. Although lacking fruit the identity of these collections is reasonably sure. The gap in distribution is wide but not without precedent when the alpine moss flora of Guatemala is considered as a whole.

4. DITRICHUM STEYERMARKII Bartr., Bryol. **49**: 110. 1946.

Slender, dull yellowish green plants, densely tufted. Stems 1.5–2 cm. high, simple or branched above, sparingly radiculose below. Leaves erect-appressed when dry, erect-spreading when moist, 3.5–4 mm. long, gradually subulate-acuminate from an oblong, concave base, sharply serrate at extreme apex; costa broad and indistinct below, short excurrent; upper leaf cells subquadrate, diam. 8–10 μ, basal cells narrowly rectangular, hyaline. Perichaetial leaves

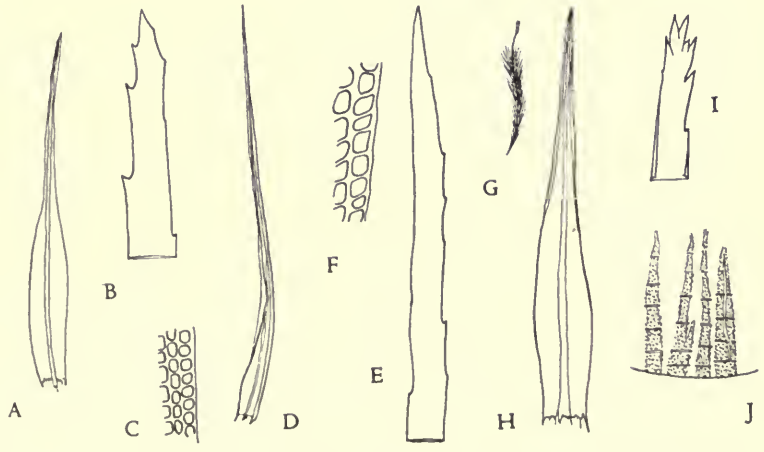

FIGURE 13

A–C, *Ditrichum longicaule:* A, leaf, ×14; B, apex of leaf, ×110; C, upper leaf cells and margin, ×270.

D–F, *Ditrichum giganteum:* D, leaf, ×8; E, apex of leaf, ×110; F, upper leaf cells and margin, ×270.

G–J, *Ditrichum Steyermarkii:* G, plant, ×1; H, leaf, ×14; I, apex of leaf, ×110; J, part of peristome, ×110.

abruptly narrowed from a clasping base to a linear-subulate point. Seta short, 5 mm. long; capsule erect, ovoid-cylindrical, barely exceeding the tips of the perichaetial leaves; urn scarcely 2 mm. long; operculum red, conic-rostrate, 1 mm. long; peristome teeth 16, pale, densely papillose, irregularly cleft, not bifid; spores smooth, diam. 10 μ. (Fig. 13, G–J.)

Dept. San Marcos: Along road between San Sebastian at km. 21 and km. 8, 8–18 miles northwest of San Marcos, alt. 2,700–3,800 m., *Steyermark 35657*, TYPE.

Crevices of banks of dry slope. A highly individual species characterized by the short setae and irregularly cleft peristome teeth.

5. DITRICHUM AMBIGUUM Best, Bull. Torr. Bot. Club **20**: 117. 1893.

Dioicous; dull yellowish green plants. Stems to 1.5 cm. high. Leaves crowded, erect with spreading points when dry, 1.5–2 mm. long, ovate-lanceolate, subulate-acuminate; margins slightly recurved, entire or weakly toothed; costa percurrent; cells rectangular, incrassate. Seta 8–9 mm. long; capsule erect, cylindric; lid conic-rostrate, nearly 1 mm. long; peristome teeth divided to the short basal membrane, densely and sharply papillose. (Fig. 14, A–D.)

Dept. Sacatepequez: *Standley 60245*.

Distribution: British Columbia to California.

On dry open bank at moderate altitude. The differences between this collection and authentic material of *D. ambiguum* are negligible and I have little hesitation in referring them here.

6. DITRICHUM RUFESCENS (Hampe) Broth., E. & P. Nat. Pflanzenf. 1^3: 300. 1901.

Leptotrichum rufescens Hampe, Linnaea **31**: 521. 1862.

Paroicous; antheridia in a bud-like cluster just below the perichaetium. Slender, silky plants, densely tufted, green above, reddish brown below. Stems erect, to 1 cm. high, sparsely radiculose. Leaves erect, flexuous, the uppermost to 3.5 mm. long, slenderly subulate-acuminate from a short, ovate base; margins erect, entire; costa broad and poorly defined below, excurrent with a few blunt teeth at apex; cells linear, smooth. Seta to 2 cm. long, pale, becoming reddish with age; capsule slightly curved, urn to 3 mm. long, small-mouthed; lid conic-rostrate, 1 mm. long; annulus broad; peristome teeth erect, pale red, cleft to base into 2 filiform, densely papillose forks; spores smooth, pale, diam. 10–12 μ. (Fig. 11, F–H.)

Dept. El Quiche: *Sharp 5307*. Dept. Huehuetenango: *Sharp 4879, 4904, 4950*.

Distribution: Mexico to Colombia, West Indies, Venezuela.

Moist, shaded banks at moderately high altitudes. This species fruits freely and will be easily recognized by the paroicous inflorescence.

5. SELIGERIACEAE

Slender or small mostly rupestral plants. Leaves subulate-acuminate from a broader base; costa strong, excurrent; cells smooth, alar group strongly differentiated in *Blindia*. Seta erect or curved; capsule pyriform, wide-mouthed; peristome single, of 16 undivided teeth.

1. BLINDIA Bry. Eur. fasc. **33–36.** 1846.

Plants medium sized. Stems branched. Leaves lanceolate; cells narrow, smooth, incrassate, inflated and colored at basal angles in a conspicuous group. Seta elongate; capsule turbinate when dry, peristome teeth 16, smooth, entire; annulus lacking.

1. BLINDIA ACUTA (Hedw.) Bry. Eur. fasc. **33–36.** 1846.

Weisia acuta Hedw., Sp. Musc. 71. 1801.

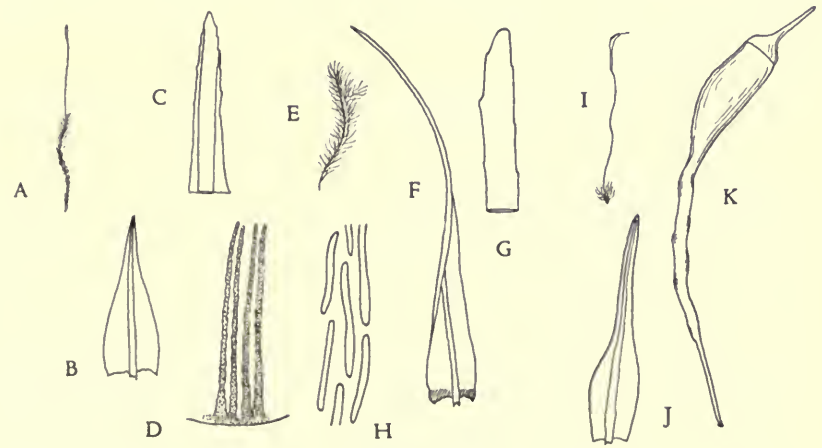

FIGURE 14

A–D, *Ditrichum ambiguum:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×110; D, part of peristome, ×110.

E–H, *Blindia acuta:* E, plant, ×1; F, leaf, ×14; G, apex of leaf, ×110; H, basal leaf cells, ×270.

I–K, *Trematodon longicollis:* I, plant, ×1; J, leaf, ×14; K, capsule, ×8.

Dioicous; plants tufted; stems slender, branched. Leaves subsecund, long subulate from a triangular-lanceolate, concave base, 3–3.5 mm. long, entire; costa strong, long excurrent, obscurely toothed at tip; cells linear, smooth, very incrassate, shorter at extreme base and colored across insertion, alar group large and conspicuous, subquadrate, deep brown. Seta 3–10 mm. long; capsule turbinate when dry and empty. (Fig. 14, E–H.)

Dept. Quezaltenango: *Standley 83684*.

Distribution: Greenland to Alaska south to northern United States, Europe, Asia.

On wet sand at high altitude. This collection is sterile but as far as the vegetative characters are concerned it is certainly good *Blindia acuta*.

6. DICRANACEAE

Plants often robust, closely tufted. Stems simple or forked, densely foliate, tomentose below. Leaves erect or secund, often crispate, lanceolate; costa single, usually well developed; basal cells rectangular, smaller and usually subquadrate above, alar group usually strongly differentiated. Seta mostly elongate, straight or cygneous; capsules erect or curved, cylindric or ovoid, often plicate; peristome single, of 16 teeth, cleft to or below middle, usually striolate below, papillose above; lid conic-rostrate; calyptra cucullate, entire or fringed at base.

1. Capsule neck slender and spongy, longer than urn.....1. *Trematodon*
   Capsule neck inconspicuous, shorter than urn..... 2
2. Alar cells clearly differentiated..... 3
   Alar cells not or scarcely differentiated..... 9
3. Costa broad, ⅓ the width of leaf base or more..... 4
   Costa narrow, less than ⅓ the width of leaf base..... 7
4. Seta strongly cygneous or flexuous when moist..... 5
   Seta erect and straight..... 6
5. Upper leaf cells oval or rhomboidal, calyptra usually fringed..5. *Campylopus*
   Upper leaf cells linear, calyptra not fringed.....8. *Dicranodontium*
6. Calyptra fringed, peristome teeth undivided.....7. *Pilopogon*
   Calyptra not fringed, peristome teeth bifid.....6. *Atractylocarpus*
7. Leaves with a hyaline border.....17. *Leucoloma*
   Leaves not bordered..... 8
8. Peristome teeth papillose, perichaetium conspicuous.....15. *Holomitrium*
   Peristome teeth striolate, perichaetium inconspicuous.....16. *Dicranum*

9. Leaf cells mammillose or papillose 10
Leaf cells smooth 11

10. Peristome lacking, leaf cells papillose ..... 10. *Amphidium*
Peristome present, leaf cells mammillose ..... 12. *Oncophorus*

11. Costa broad, occupying more than ½ of leaf base ..... 9. *Brothera*
Costa narrow, less than ⅓ the width of leaf base 12

12. Seta stout, strongly curved when moist ..... 4. *Campylopodium*
Seta slender, erect 13

13. Leaves appressed, male flower conspicuous, discoid ..... 2. *Aongstroemia*
Leaves spreading, male flower inconspicuous, gemmiform 14

14. Leaves erect-spreading, not crispate ..... 3. *Dicranella*
Leaves crispate when dry 15

15. Small, delicate plants, capsule 8 ribbed, seta short ..... 11. *Rhabdoweisia*
Larger plants, capsule smooth, seta elongate 16

16. Leaf base obovate, sheathing, abruptly narrowed to blade .. 13. *Symblepharis*
Leaf base oblong, gradually narrowed upward ..... 14. *Dicranoweisia*

1. TREMATODON Michx., Fl. Bor. Amer. **2**: 289. 1803.

Small gregarious plants. Leaves slenderly pointed from an ovate, concave base; costa ending below apex; cells smooth. Seta elongate; capsule curved, with a neck about twice as long as urn; peristome single, of 16 teeth.

1. TREMATODON LONGICOLLIS Michx., Fl. Bor. Amer. **2**: 289. 1803.

Trematodon reflexus C. M., Syn. **1**: 459. 1848.

Autoicous: stems 2–3 mm. high. Leaves spreading, flexuous, abruptly linear from an ovate, concave base, blunt and toothed at apex; costa stout, ending under apex; cells rectangular, more elongate below. Seta yellow, 1–3 cm. long; capsule curved, cylindric, urn 2 mm. long, neck often longer than urn and strumose at base; peristome teeth reddish brown from a low basal membrane, vertically striolate; annulus broad; lid long beaked; spores about 20μ in diam. (Fig. 14, I–K.)

Distribution: Eastern United States, Mexico, Cuba, South America, Europe, Philippines, New Guinea, Ceylon.

This widely distributed species has been recorded from Guatemala but I have seen no local collections and it does not appear in any of Standley's or Steyermark's collections.

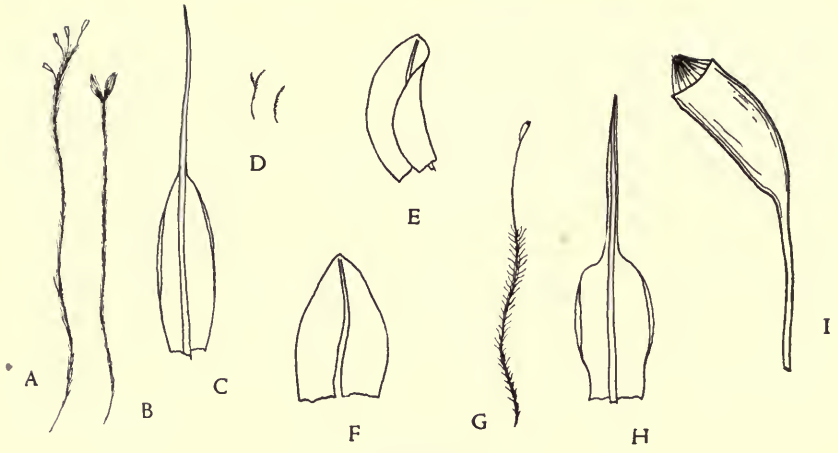

FIGURE 15

A–C, *Aongstroemia jamaicensis:* A, fertile plant, ×1; B, male plant, ×1; C, leaf, ×14.
D–F, *Aongstroemia orientalis:* D, plants, ×1; E and F, leaves, ×27.
G–I, *Dicranella vaginata:* G, plant, ×1; H, leaf, ×14; I, capsule, ×8.

2. AONGSTROEMIA Bry. Eur. fasc. **33–36.** 1846.

Stems short to slender and elongate, julaceous. Leaves appressed, ovate; costa strong; cells rather elongate and smooth. Seta smooth, erect; capsule erect, ovoid-cylindric; peristome teeth when present inserted below rim, often split or perforate.

Plants 4–6 cm. high, leaves acuminate ..... 1. *A. jamaicensis*
Plants less than 1 cm. high, leaves obtuse ..... 2. *A. orientalis*

1. AONGSTROEMIA JAMAICENSIS C. M., Bull. Herb. Boiss. **5:** 554. 1897.

Dioicous; antheridial buds conspicuous. Plants glossy; stems mostly simple, laxly tufted, to 6–7 cm. high. Leaves appressed, abruptly subulate from an oblong-ovate, clasping base, to 4–5 mm. long; margins erect; costa long excurrent in a slender, smooth awn; lowest cells rectangular, becoming linear-vermicular upward. Seta 3–4 mm. long; capsule cylindric, urn 1.5–2 mm. long, brown, exceeded by tips of perichaetial leaves; peristome teeth reddish, narrow, papillose, forked about half way down, perforate below. (Fig. 15, A–C.)

Dept. San Marcos: *Steyermark 35951, 36441a, 36442; Standley 86420.* Dept. Totonicapan: *Standley 65920, 65941.* Dept. Quezaltenango: *Standley 68074, 84926.*

Distribution: Jamaica, Mexico, Costa Rica.

Damp banks at high altitudes. The delicate, filiform, glossy stems of this species are distinctive and not likely to be confused with anything else.

2. AONGSTROEMIA ORIENTALIS Mitt., Trans. Linn. Soc. **2**: 154. 1891.

Small, slender, yellowish green plants, closely gregarious. Stems simple or little branched, less than 1 cm. long. Leaves minute, appressed with secund points, 0.5–0.8 mm. long, ovate, obtuse; margins erose-denticulate nearly to base; costa ending below apex; cells oval-rhomboidal, smooth, incrassate, elongate below. Seta 8–10 mm. long; capsule erect; peristome lacking. (Fig. 15, D–F.)

Dept. Huehuetenango: *Steyermark 50228*. Dept. San Marcos: *Steyermark 36090, 36118a*.

Distribution: Mexico, Himalayas, Burma, Yunnan, Philippine Islands.

Dry slopes at high altitudes. This curious little moss has been found in fruit in Mexico but the local collections are sterile.

3. DICRANELLA Schimp., Coroll. Bry. Eur. fasc. **13**. 1855.

Small terrestrial plants growing in tufts or mats. Leaves spreading, narrowly lanceolate; costa stout; cells smooth, alar group not differentiated. Seta slender, erect; capsules erect or inclined; peristome of 16 reddish teeth usually cleft to about middle; lid conic-rostrate, oblique.

1. Leaves squarrose-spreading, from an erect, obovate, sheathing base ..... 1. *D. vaginata*
   Leaves erect-spreading from insertion 2
2. Capsules cernuous, asymmetrical ..... 4. *D. varia*
   Capsules erect, symmetrical 3
3. Peristome teeth irregularly papillose on outer surface 4
   Peristome teeth striolate on outer surface 5
4. Peristome teeth 225–250 μ high, leaves abruptly narrowed from an oblong base ..... 6. *D. Sharpii*
   Peristome teeth 100 μ high, leaves ovate-lanceolate ..... 5. *D. alpina*
5. Seta 10–15 mm. long, peristome 200–250 μ high 6
   Seta 5–6 mm. long, peristome under 125 μ high 7
6. Seta reddish, capsules contracted under mouth when dry ..... 3. *D. subinclinata*
   Seta yellowish, capsules not contracted under mouth ..... 2. *D. Hilariana*
7. Blade of inner perichaetial leaves as long as basal part ..... 7. *D. lagunaria*
   Blade of inner perichaetial leaves twice as long as basal part ..... 8. *D. brachyblepharis*

1. DICRANELLA VAGINATA (Hook.) Card., La Flore Bryol. d. Ter. Mag. etc. 60. 1908.

Dicranum vaginatum Hook., Musc. Exot. pl. 141. 1820.
Dicranella Standleyi Bartr., Contrib. U. S. Nat. Herb. 26[3]: 57. 1928.

Plants laxly gregarious, slender, 1–4 cm. high. Upper leaves 3–4 mm. long from an obovate, erect, clasping base abruptly narrowed to a spreading setaceous point; costa percurrent; basal cells rectangular, shorter and irregular at shoulders, subquadrate and slightly incrassate above. Seta erect, 10–12 mm. long; capsules erect or nodding; peristome teeth reddish brown, densely papillose, divided to below middle; lid long subulate-rostrate. (Fig. 15, G–I.)

Dept. San Marcos: *Standley 66247*. Dept. Jutiapa: *Steyermark 31938*.

Distribution: Mexico, Costa Rica, Colombia, Ecuador.

On damp banks at high altitudes. It seems more logical to confine *Aongstroemia* to the species with erect, appressed leaves and include *Aongstroemia vaginata* (Hook.) Card. in *Dicranella* where it belongs from every point of view.

2. DICRANELLA HILARIANA (Mont.) Mitt., Journ. Linn. Soc. **12**: 31. 1869.

Dicranum Hilarianum Mont., Ann. Sci. Nat. II. **12**: 52. 1839.

Small, laxly tufted, pale green plants. Leaves spreading, to 2 mm. long, narrowly lanceolate, gradually narrowed to a blunt, toothed apex; costa stout, ending below apex; upper cells short rectangular, more elongate below. Seta about 10 mm. long; capsule erect; peristome teeth vertically striolate below, to 200 μ long, divided to below middle. (Fig. 17, A–D.)

Dept. Quezaltenango: *Standley 65348*.

Distribution: Southern United States, Mexico, West Indies, Central and South America.

The above collection is sterile and doubtful but the species should eventually be found in Guatemala, which is well within its geographical range.

3. DICRANELLA SUBINCLINATA Lor., Moosst. 160. 1864.

Slender, yellowish green plants, densely tufted. Stems about 1 cm. high, sparsely branched. Leaves erect with slightly contorted points when dry, more rigid when moist, gradually linear-lanceolate from an ovate base, to 2 mm. long, bluntly rounded and toothed

at apex; costa ending just below apex; upper cells rectangular with firm, pellucid walls, gradually becoming linear toward base. Seta to 8 or 10 mm. long, reddish; capsule dark brown, contracted below mouth when dry; peristome as in *D. Hilariana*. (Fig. 16, A–C.)

Dept. Baja Verapaz: *Sharp 2948*.

Distribution: Mexico, Central America, West Indies.

On bank at moderate altitude. Readily separated from *D. Hilariana* by the stouter, reddish setae and the capsules contracted below the mouth when dry.

4. DICRANELLA VARIA (Hedw.) Schimp., Coroll. Bry. Eur. 13. 1855.

Dicranum varium Hedw., Sp. Musc. 133. 1801.

Small, slender, densely tufted plants, brownish green. Stems to 4 or 5 mm. high. Leaves erect when dry, erect-spreading or slightly secund when moist, the upper to 1.5 mm. long, smaller below, triangular-lanceolate, short acuminate; margins recurved below, denticulate near apex; costa percurrent; cells linear. Seta 7–8 mm. long, reddish; capsule nodding, curved and asymmetrical, urn about 1 mm. long, wide-mouthed; peristome relatively large, teeth reddish,

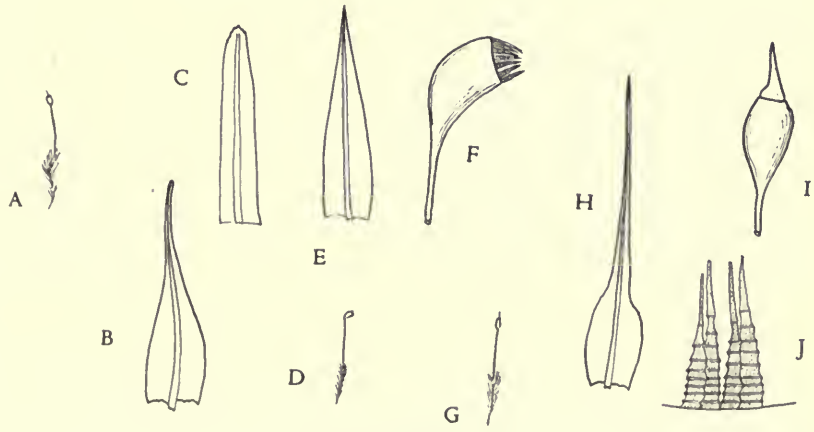

FIGURE 16

A–C, *Dicranella subinclinata:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×110.

D–F, *Dicranella varia:* D, plant, ×1; E, leaf, ×20; F, capsule, ×12.

G–J, *Dicranella Sharpii:* G, plant, ×1; H, leaf, ×40; I, capsule, ×8; J, part of peristome, ×110.

250–300 μ high, cleft half way down, striolate; annulus lacking; lid short rostrate. (Fig. 16, D–F.)

Dept. Baja Verapaz: *Sharp 2948.*

Distribution: New Brunswick to Alaska south to Mexico, Florida and Cuba.

On moist bank at moderate altitude. Several collections have been recorded from Mexico and Cuba but the Guatemalan specimens extend the range appreciably to the southward.

5. DICRANELLA ALPINA (C. M.) Par., Ind. Bryol. Suppl. 115. 1900.

Angstroemia alpina C. M., Bull. Herb. Boiss. **5**: 186. 1897.

Plants similar to the following species. Seta elongate; capsule erect; peristome teeth about 0.1 mm. high, papillose (not striolate).

Nagula, alt. 9,000 ft., *Bernoulli & Cario 64.* Dept. Alta Verapaz: *Turckheim 6653.*

Distribution: Mexico.

6. DICRANELLA SHARPII Bartr., Bryol. **50**: 202. 1947.

Slender, tufted, yellowish plants. Stems erect, 6–7 mm. high. Leaves erect, minute below, the upper to 4 mm. long, abruptly lanceolate-subulate from an oblong base about 1 mm. long, sharply acute; margins entire; costa well defined excurrent; upper leaf cells very narrow, gradually becoming rectangular below with firm lateral walls. Seta 7 mm. long, yellowish; capsule erect, oblong, brownish, urn 1.5 mm. long, slightly angulate when dry; peristome teeth 225–250 μ high, irregularly cleft to about middle, papillose, not striolate; lid obliquely rostrate; annulus broad; spores papillose, diam. 16–18 μ. (Fig. 16, G–J.)

Dept. El Quiche: *Sharp 2448.* Dept. Baja Verapaz: *Sharp 5188.*

Endemic.

On banks at moderate altitudes. This species seems to be clearly distinct from both *D. barbensis* Ren. & Card. and *D. alpina* C. M. in the much longer peristome teeth and the leaves abruptly narrowed above the oblong base to an almost setaceous point with the costa plainly excurrent. The length of the peristome varies somewhat with the size of the capsules but even in the smaller forms the teeth are over 200 μ high.

7. DICRANELLA LAGUNARIA (C. M.) Broth., E. & P. Pflanzenf. **1**[3]: 309. 1901.

Aongstroemia lagunaria C. M., Bull. Herb. Boiss. **5**: 187. 1897.

Small plants. Stems to 8 mm. high. Leaves crowded, erect-spreading, ovate-lanceolate, bluntly acute; costa ending below apex; cells slightly incrassate, rectangular, more elongate below. Seta 5–6 mm. long; capsule erect; peristome teeth about 0.1 mm. long, striolate below, entire or irregularly cleft.

Laguna del Pino, *Bernoulli & Cario 116*.

Endemic.

Known only from the type collection.

8. DICRANELLA BRACHYBLEPHARIS (C. M.) Mitt., Journ. Linn. Soc. **12**: 34. 1869.

Aongstroemia brachyblepharis C. M., Syn. **1**: 435. 1848.

Small plants to 1 cm. high. Leaves distant, ovate-lanceolate; costa subpercurrent; cells rectangular. Perichaetial leaves to 4 mm. long, gradually narrowed to a point twice as long as the ovate base; seta 5 mm. long; capsule erect; peristome as in preceding species. (Fig. 17, E–H.)

Distribution: Mexico, Jamaica.

I have seen no local specimens of either this species or *D. lagunaria*.

4. CAMPYLOPODIUM (C. M.) Besch., Ann. Sci. Nat. V. **18**: 189. 1873.

Angstroemia Sect. *Campylopodium* C. M., Syn. **1**: 429. 1848.

Small plants similar in habit and appearance to *Dicranella* but differing markedly in the stout, curved or cygneous setae. Capsules ribbed when dry; peristome teeth striolate, cleft about half way down.

1. CAMPYLOPODIUM PUSILLUM (Schimp.) Williams, No. Amer. Flora **15**[2]: 94. 1913.

Campylopus pusillus Schimp., Mem. Soc. Sci. Nat. Cherb. **16**: 165. 1872.
Dicranum magnirete C. M., Bull. Herb. Boiss. **5**: 186. 1897.
Dicranum Turckheimii C. M., Bull. Herb. Boiss. **5**: 186. 1897.

Laxly gregarious, yellowish green plants. Stems to 1 cm. high. Leaves spreading, flexuous, to 4 mm. long, abruptly narrowed from

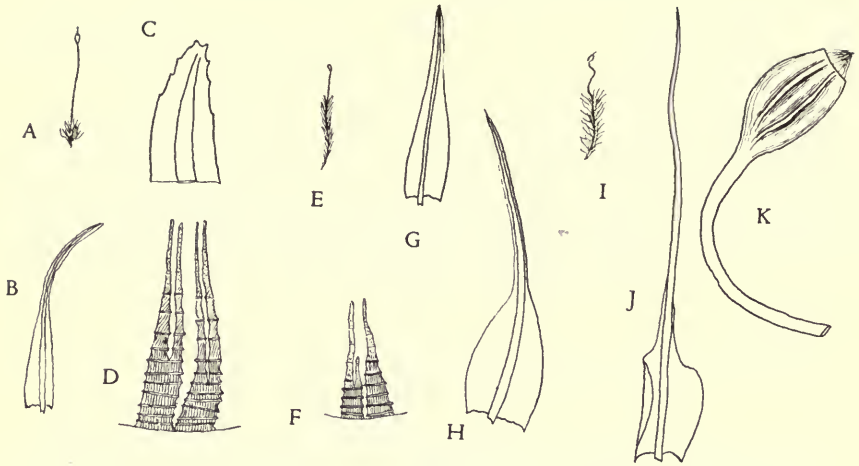

FIGURE 17

A–D, *Dicranella Hilariana:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×110; D, part of peristome, ×134.

E–H, *Dicranella brachyblepharis:* E, plant, ×1; F, part of peristome, ×134; G, stem leaf, ×14; H, perichaetial leaf, ×14.

I–K, *Campylopodium pusillum:* I, plant, ×1; J, leaf, ×14; K, capsule, ×14.

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a short, ovate, clasping base to a long subulate point; costa stout, excurrent, basal cells rectangular, alar cells not differentiated, shorter and irregular at shoulders, linear above in the narrow blade. Seta stout, brown, to 6 mm. long, flexuous when dry, cygneous when moist; capsule oval; lid obliquely rostrate; spores coarsely papillose, diam. 20–24 μ. (Fig. 17, I–K.)

Dept. San Marcos: *Standley 86515a.*

Distribution: Mexico, Jamaica, South America.

On tree in wet forest at rather high altitude. The short, broad leaf base without any differentiated alar cells, abruptly narrowed to a long, subulate point will distinguish this species from *Campylopus.*

5. CAMPYLOPUS Brid., Musc. Rec. Suppl. 4: 71. 1819.

Dioicous; small to robust plants, densely tufted. Stems often branching, radiculose below. Leaves erect or curved, ovate-lanceolate, slenderly acuminate, channelled above; margins usually toothed above; costa very broad below, percurrent or excurrent, often ribbed on back; basal cells narrow, alar group enlarged, hyaline or colored, usually conspicuous, upper cells mostly rhomboidal to short rectangular. Seta usually strongly cygneous when moist; capsules

ovoid, usually ribbed when dry; peristome teeth divided about half way down, striolate below; lid rostrate; calyptra cucullate, generally fringed at base.

The species of this difficult genus may be separated into three groups based on the structure of the costa in cross section.

Costa without stereid bands (*Pseudocampylopus*): *C. guatemalensis.*

Costa with stereid band on dorsal side only (*Eucampylopus*): *C. Chrismari, C. flexuosus, C. fragilis, C. concolor, C. Jamesoni, C. introflexus.*

Costa with stereid bands on both sides of median guide row (*Palinocraspis*): *C. savannarum, C. filifolius, C. arctocarpus, C. Richardi.*

1. Marginal cells of leaf base short, quadrate, chlorophyllose..8. *C. savannarum*
   Marginal cells of leaf base elongate, hyaline..... 2
2. Leaves generally with hyaline tips..... 3
   Leaves with concolorous tips..... 4
3. Costa strongly ridged on back, basal cells hyaline, thin walled..7. *C. introflexus*
   Costa smooth or faintly ridged on back, basal cells incrassate, porose
   11. *C. Richardi*
4. Cells of leaf base with firm, pellucid walls..... 5
   Cells of leaf base lax, with thin, delicate walls..... 7
5. Basal cells more or less pitted, costa with stereid bands on both sides of median guide row..... 6
   Basal leaf cells not pitted, costa with dorsal stereid band only, ventral cells large.....3. *C. flexuosus*
6. Leaves in interrupted tufts, apex slender.....9. *C. filifolius*
   Stems equally foliate, apex of leaf short and stout.....10. *C. arctocarpus*
7. Leaf base distinctly bordered to shoulders with 6–10 rows of linear, hyaline cells.....2. *C. Chrismari*
   Leaf base not distinctly bordered..... 8
8. Alar cells not differentiated.....4. *C. fragilis*
   Alar cells strongly differentiated..... 9
9. Leaves 4–4.5 mm. long, entire except at extreme apex, costa without stereids
   1. *C. guatemalensis*
   Leaves 10 mm. or more long, costa with dorsal stereid band..... 10
10. Costa less than 1 mm. wide.....5. *C. concolor*
    Costa over 1 mm. wide.....6. *C. Jamesoni*

1. CAMPYLOPUS GUATEMALENSIS Bartr., Bryol. **49**: 110. 1946.

Slender, compactly tufted, pale green plants, slightly glossy. Stems branched, tomentose nearly to tips, 2–6 or 7 cm. high. Leaves

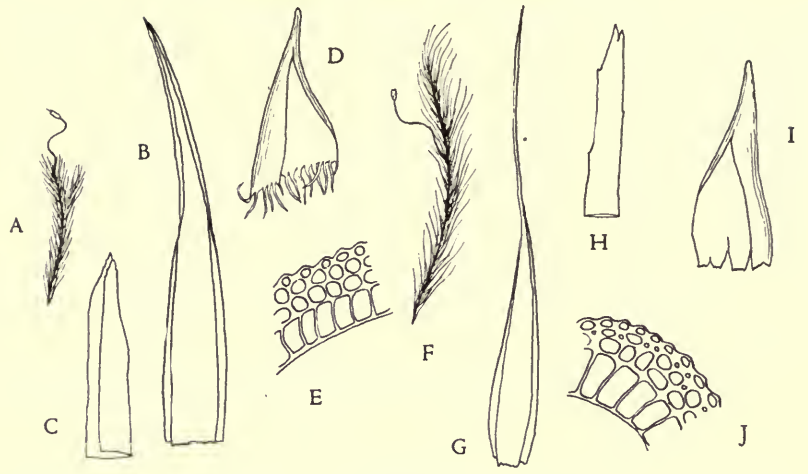

FIGURE 18

A–E, *Campylopus guatemalensis:* A, part of plant, ×1; B, leaf, ×14; C, apex of leaf, ×110; D, calyptra, ×14; E, part of cross section of costa, ×270.

F–J, *Campylopus Chrismari:* F, part of plant, ×1; G, leaf, ×8; H, apex of leaf, ×110; I, calyptra, ×14; J, part of cross section of costa, ×270.

erect-spreading, 4–6 mm. long, narrowly lanceolate, tubulose above, entire except for a few teeth at extreme apex; costa at least ¾ the width of leaf base, long excurrent, without stereids; basal cells rectangular, thin walled, alar group conspicuous, hyaline or brownish, inflated and auriculate, upper cells small, rhomboidal. Seta 5 mm. long, bent near middle or strongly sinuous; capsule elliptic, urn 1.5 mm. long; calyptra fringed at base. (Fig. 18, A–E.)

Dept. Totonicapan: *Standley 83101a.* Dept. Quezaltenango: *Standley 86121, 86125, 86137, 86159* TYPE, *86182, 86186; Steyermark 34656.*

Endemic.

On rocks in alpine regions. Although near *C. Schimperi* Milde even in structural details, I feel that these plants are best treated as a distinct species. The longer leaves, in some cases reaching 5–6 mm., more spreading both moist and dry, are distinctive features. It will be separated from *C. Chrismari* by the unbordered leaf base, the more conspicuous alar cells and the calyptra fringed at the base.

2. CAMPYLOPUS CHRISMARI (C. M.) Mitt., Journ. Linn. Soc. **12**: 88. 1869.

Dicranum Chrismari C. M., Bot. Zeit. **13**: 761. 1855.

Slender, silky, glossy, yellowish green plants growing in compact tufts. Stems branched, to 6–7 cm. high. Leaves spreading, often secund, to 6–7 mm. long, from a short, ovate base tapering gradually to a long, tubulose, setaceous point, denticulate only at extreme apex; costa long excurrent, with a weak stereid band on the dorsal side only; basal cells rectangular, thin walled, very narrow and elongate toward margins forming a wide, distinct hyaline border, enlarged alar cells few, inconspicuous, upper cells irregularly rhomboidal, longer than wide. Seta 12–15 mm. long, cygneous; capsule narrowly ovoid; calyptra not fringed at base. (Fig. 18, F–J.)

Dept. San Marcos: *Steyermark 36104*. Dept. Totonicapan: *Standley 62688, 62706a, 62707, 62729, 65869, 84417, 84502, 84516, 84562a*. Dept. Quezaltenango: *Standley 67691, 67774, 67449, 85868, 85890; Steyermark 34182, 34846*. Dept. Chimaltenango: *Standley 61844a, 61847*.

Distribution: Mexico, Costa Rica.

On banks, rocks and trees in alpine regions. The scattered stereid cells on the dorsal side of the costa indicate that this species should be included in the Sec. *Eucampylopus*. In well developed plants the wide border of narrow cells extending nearly to the top of the leaf base is a reliable diagnostic character.

3. CAMPYLOPUS FLEXUOSUS (Hedw.) Brid., Musc. Rec. Suppl. **4**: 71. 1819.

Dicranum flexuosum Hedw., Sp. Musc. 145. 1801.

Campylopus gracilicaulis Mitt., Journ. Linn. Soc. **12**: 83. 1869.

Dicranum Hellerianus Hampe, Verh. Zool.-Bot. Ges. Wien **19**: 507. 1869.

Campylopus tallulensis S. & L. Sull., Ic. Musc. 27. 1872.

Dicranum Donnellii Aust., Bot. Gaz. **4**: 150. 1879.

Dicranum subleucogaster C. M., Bull. Torr. Bot. Club **5**: 49. 1879.

Campylopus Sargii Roll., Bull. Soc. Bot. Belg. 38^1: 8. 1900.

Campylopus Roellii Ren. & Card., Bull. Soc. Bot. Belg. 38^1: 9. 1900.

Campylopus straminifolius Bartr., Contr. U. S. Nat. Mus. 26^3: 63. 1928.

Campylopus hondurensis Bartr., Field Mus. Nat. Hist. Bot. Ser. 4^9: 351. 1929.

Variable plants; stems 1–6 or 7 cm. high, often with clusters of microphyllous branchlets near tips. Leaves rigid or flexuous when dry, oblong-lanceolate, gradually narrowed to a channeled, subulate point, serrulate toward apex; costa mostly excurrent; basal cells short rectangular toward costa, narrower toward margins, gradually or quickly becoming smaller and subquadrate upward, with firm, pellucid, unpitted walls, alar cells usually inflated and auriculate,

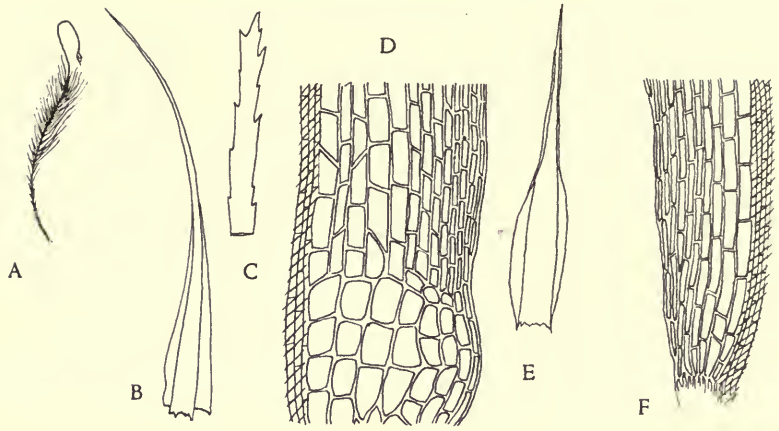

FIGURE 19

A–D, *Campylopus flexuosus:* A, plant, ×1; B, leaf, ×8; C, apex of leaf, ×134; D, one side of leaf base, ×134.

E–F, *Campylopus fragilis:* E, leaf, ×10; F, one side of leaf base, ×134.

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hyaline or colored, upper cells short rhomboidal. Seta 8–10 mm. long, strongly curved or cygneous; capsule ovoid, ribbed; calyptra fringed at base. (Fig. 19, A–D.)

Dept. Alta Verapaz: *Standley 71051, 9062, 90784, 92068.* Dept. San Marcos: *Standley 68592, 68613.* Dept. Totonicapan: *Standley 62664.* Dept. Quezaltenango: *Steyermark 33471; Standley 65334, 67371, 67417* (distr. as *C. Chrismari*), *67427* (as *C. Chrismari*), *67429* (as *C. Chrismari*), *67460* (as *C. Chrismari*), *83321, 83376, 83386, 85913, 85916, 85964, 86013, 86033, 86044* (as *C. Chrismari*), *86048, 86051.* Dept. Chimaltenango: *Standley 61910* (as *C. Chrismari*). Dept. Guatemala: *Standley 58424, 80620, 80728.* Dept. Zacapa: *Steyermark 42660.* Dept. Chiquimula: *Steyermark 30608.*

Distribution: Southern United States, Mexico, Central America, Europe.

On damp banks, trees and logs at medium to high altitudes. *C. flexuosus* is well marked in a broad way by the rectangular cells of the leaf base with firm unpitted, pellucid lateral walls, appreciably larger toward costa and gradually narrower toward margins. It is an exceedingly variable species and many closely related forms have been described from tropical and subtropical North America based on more or less trivial and inconstant characters which to my mind are not amenable to any orderly or practical classification. These rectangular basal cells change gradually to the small, rhomboidal cells of the upper leaf blade but the gradation is so irregular in plants of the same tuft or even on the same stem that I doubt if it can be

used as a specific indicator. For this reason it seems as though *C. gracilicaulis* Mitt. naturally falls into the same concept. The robust forms with tall stems and broader costa include *C. Roellii* and *C. Hellerianus* while at the other extreme small plants about 1 cm. high with the costa only 150 μ wide or less seem to be inseparable from *C. Sargii*.

4. CAMPYLOPUS FRAGILIS (Turn.) Bry. Eur. fasc. **41.** 1847.

Dicranum flexuosum fragile Turn., Musc. Hib. 74. 1804.

Rather small, densely tufted, yellowish green plants. Stems 1–4 cm. high, densely foliate. Leaves suberect and slightly flexuous when dry, narrowly lanceolate from a pale, oblong base, serrulate toward apex; basal cells rectangular, thin walled, hyaline, narrower toward margins and shorter and subrhomboidal toward leaf shoulders, upper cells short rhomboidal, differentiated alar cells few or none, never auriculate. Seta 5–8 mm. long; calyptra fringed. (Fig. 19, E–F.)

Dept. Alta Verapaz: *Standley 69112* (as *C. Chrismari*). Dept. Huehuetenango: *Standley 65844* (as *C. Chrismari*); *Steyermark 50188*. Dept. San Marcos: *Steyermark 36391*. Dept. Totonicapan: *Standley 84107*. Dept. Chimaltenango: *Standley 58745a*.

Distribution: Florida, Jamaica, Europe, Asia, Africa.

On damp banks and trees at medium to high altitudes. These collections are all sterile but the typical leaf base with few or no enlarged alar cells confirms the determination with reasonable certainty.

5. CAMPYLOPUS CONCOLOR (Hook.) Brid., Bryol. Univ. **1**: 476. 1826.

Dicranum concolor Hook., Musc. Exot. tab. 138. 1820.

Robust pale green plants, slightly lustrous. Stems to 6 cm. high, uniformly and densely foliate. Leaves spreading, with long flexuous or secund setaceous points, gradually narrowed from a slender, concave base, 10–14 mm. long, serrulate for some distance below apex; costa excurrent, to 0.8 mm. wide below, stereids on dorsal side only; basal cells rectangular, thin walled, quickly changing to the small, irregular, subquadrate cells of the upper lamina which is only 1 or 2 cells wide for some distance down, enlarged alar cells auriculate, pale or hyaline. Seta short; capsules asymmetrical; calyptra fringed. (Fig. 20, A–D.)

Dept. San Marcos: *Standley 86229, 86300, 86391; Steyermark 36799*. Dept. Quèzaltenango: *Steyermark 34325; Standley 85675*.

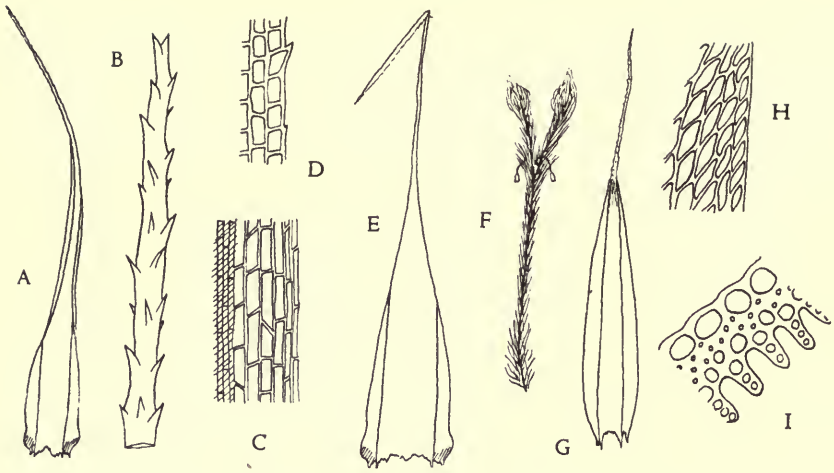

FIGURE 20

A–D, *Campylopus concolor:* A, leaf, ×6; B, apex of leaf, ×110; C, basal leaf cells next costa, ×134; D, upper leaf cells and margin, ×270.

E, *Campylopus Jamesoni:* E, leaf, ×6.

F–I, *Campylopus introflexus:* F, plant, ×1; G, leaf, ×8; H, upper leaf cells and margin, ×270; I, part of cross section of costa, ×270.

Distribution: Venezuela, Colombia, Peru.

On damp banks at high altitudes. Although uniformly sterile these notable collections agree in all essential particulars with authentic material of *C. concolor* from northern South America. This seems to be the first record of the species in North America.

6. CAMPYLOPUS JAMESONI (Hook.) Jaeg., Adumb. **1**: 126. 1874.

Dicranum Jamesoni Hook., Ic. Pl. r. t. 179. 1841.

Campylopus Standleyi Bartr., Contr. U. S. Nat. Mus. **26**[3]: 57. 1928.

More robust than *C. concolor*. Leaves 10–20 mm. long; costa 1–1.6 mm. wide below; auriculate alar cells smaller, more numerous and more deeply colored. Seta 12–14 mm. long; capsules asymmetrical, curved. (Fig. 20, E.)

Dept. Huehuetenango: *Steyermark 50188a.*

Distribution: Costa Rica, Colombia.

Limestone bluff of Caxin, summit Sierra de las Cuchumatanes, 3,700 m. The local record is based on a fragmentary stem in poor condition but enough to establish the species in the local flora. When Thériot's notes on *C. concolor* and *C. Jamesoni* were published

(Archiv. d. Bot. **2**: 185. 1928) neither species had been recorded from North America.

7. CAMPYLOPUS INTROFLEXUS (Hedw.) Brid., Bryol. Univ. **1**: 472. 1826.

Dicranum introflexum Hedw., Sp. Musc. 147. 1801.

Densely tufted plants; stems to 4 cm. or more high. Leaves 5 mm. or more long, laxly appressed when dry, oblong-lanceolate, subulate pointed, subtubulose above, ending in a hyaline, toothed point; costa excurrent, broad, with numerous serrated ridges 2–6 cells high on back, stereid band on dorsal side only; basal cells narrowly rectangular, alar group inconspicuous, upper cells obliquely rhomboidal. Setae often aggregated, 6–9 mm. long, scabrous near tips; capsule ovoid, rugose at base; calyptra fringed. (Fig. 20, F–I.)

Dept. Huehuetenango: *Standley 65838, 65846, 82295, 82308, 82432.* Dept. San Marcos: *Standley 68535.* Dept. Totonicapan: *Standley 84103.* Dept. Quezaltenango: *Steyermark 33188, 34834; Standley 65563, 66475, 84232, 84735, 84740.* Dept. Sacatepequez: *Standley 58816, 61229.* Dept. Solola: *Steyermark 46911, 47447, 47458* (as *C. Richardi*), *47478, 47459* (as *C. Richardi*), *47495; Standley 62349.* Dept. Guatemala: *Standley 58360, 80600, 80603, 80732.* Dept. Jutiapa: *Standley 75594.* Dept. Jalapa: *Steyermark 32163, 32602.*

Distribution: Wide in Europe, North America, South America, New Zealand, Pacific Islands.

On banks and rocks at medium to high altitudes. An abundant species of broad distribution and exceedingly variable. The hyaline basal cells, inconspicuous alar cells, the typical *Eucampylopus* costal structure and the high dorsal ridges will help to separate it from *C. Richardi.*

8. CAMPYLOPUS SAVANNARUM (C. M.) Mitt., Journ. Linn. Soc. **12**: 85. 1869.

Dicranum savannarum C. M., Syn. 2: 596. 1851.

Robust yellowish green plants; stems to 5 cm. long or longer, often branched, densely tomentose. Leaves crowded, 4–6 mm. long, tubulose above, oblong-lanceolate, acuminate, sharply serrate toward apex; costa with two stereid bands, excurrent, concolorous or hyaline at tip; basal cells short rectangular, incrassate, smaller and subquadrate at margins, upper cells oval-rhomboidal. Fruit not seen. (Fig. 21, A–F.)

Dept. San Marcos: *Steyermark 37135.* Dept. Quezaltenango: *Steyermark 33672, 33673a, 34308.* Dept. Jalapa: *Standley 76734.* Dept. Chiquimula: *Steyermark 30599.*

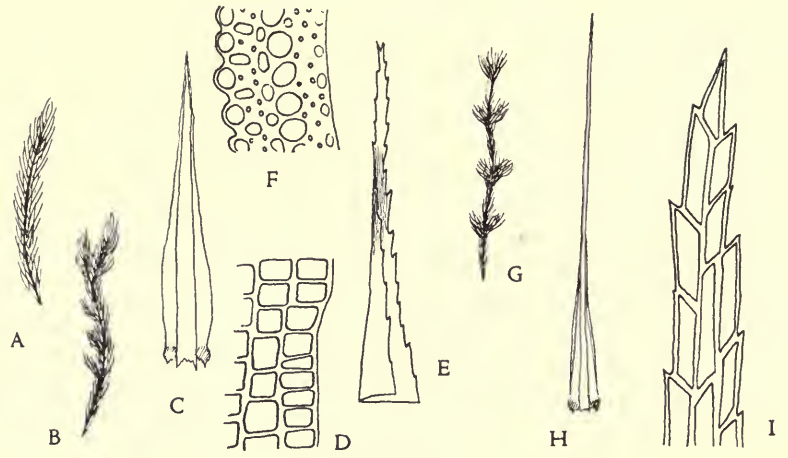

FIGURE 21

A–F, *Campylopus savannarum:* A and B, plants, ×1; C, leaf, ×8; D, basal margin of leaf, ×270; E, apex of leaf, ×54; F, part of cross section of costa, ×270. G–I, *Campylopus filifolius:* G, plant, ×1; H, leaf, ×14; I, apex of leaf, ×270.

Distribution: Costa Rica, British Guiana, Dutch Guiana.

On trees, rocks and banks at medium altitudes. The quadrate or even transversely elongate marginal cells of the leaf base are very distinctive. When I described *C. Bartletti* from British Honduras *C. savannarum* was not known from North America, but I am very doubtful if the Honduran plant can be maintained as a distinct species. The hyaline leaf tip is variable, often short or lacking and again well developed.

9. CAMPYLOPUS FILIFOLIUS (Hornsch.) Mitt., Journ. Linn. Soc. **12**: 76. 1869.

Dicranum filifolium Hornsch., Fl. Bras. 1^2: 12. 1840.

Slender plants to 4 or 5 cm. long. Leaves in interrupted tufts, curved when dry, 4–6 mm. long, from a short, narrowly ovate base gradually narrowed to a long setaceous point, serrulate for some distance below apex; costa excurrent, with two stereid bands, lamina very narrow above; basal cells rectangular, incrassate, alar cells conspicuous, reddish, slightly auriculate, upper cells rhomboidal. Seta 10–15 mm. long, cygneous when moist; capsule oblong, furrowed; calyptra fringed. (Fig. 21, G–I.)

Dept. Huehuetenango: *Steyermark 49734.*

Distribution: Costa Rica, Brazil.

On log at medium altitude. The interruptedly foliate stems and the slender setaceous pointed leaves with concolorous tips will separate this species from any of the local *Palinocraspis* group.

10. CAMPYLOPUS ARCTOCARPUS (Hornsch.) Mitt., Journ. Linn. Soc. **12:** 75. 1869.

Dicranum arctocarpum Hornsch., Fl. Bras. **1:** 12. 1840.

Densely tufted plants; stems uniformly foliate, radiculose nearly to apex. Leaves crowded, curved or flexuous when dry, 4 mm. or more long, oblong-lanceolate, gradually narrowed to a stout, denticulate point, channelled above; costa short excurrent, with two stereid bands; basal cells rectangular, incrassate, pitted, alar group reddish, conspicuous, extending to costa, upper cells rhomboidal. Seta 6–7 mm. long; capsule oblong; calyptra fringed. (Fig. 22, A–C.)

Dept. Alta Verapaz: *Standley 71298, 92300.* Dept. Totonicapan: *Standley 65887* (as *C. Richardi*). Dept. Quezaltenango: *Standley 83421.* Dept. Jalapa: *Steyermark 32489, 32493a.*

Distribution: Jamaica, South America.

On damp banks, trees and logs at moderate altitudes. These collections are sterile and not well developed. The costal structure is definitely of the *Palinocraspis* type and the leaves all with stout, concolorous tips so it seems fairly certain that they belong here.

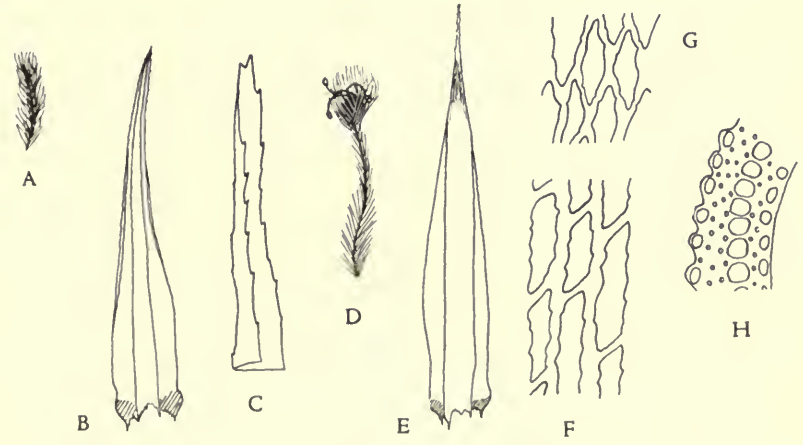

FIGURE 22

A–C, *Campylopus arctocarpus:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×110.

D–H, *Campylopus Richardi:* D, part of plant, ×1; E, leaf, ×8; F, basal leaf cells, ×270; G, median leaf cells, ×270; H, part of cross section of costa, ×270.

11. CAMPYLOPUS RICHARDI Brid., Musc. Rec. Suppl. **4**: 73. 1819.

Medium sized to robust plants, yellowish green at tips, dark brown below. Leaves erect, nearly straight when dry, crowded in comal tufts on the fertile stems, to 6 mm. or more long, oblong-lanceolate, usually with a distinct hyaline, toothed point; costa lightly ribbed on back, with two stereid bands, excurrent; basal cells linear or rectangular with pitted, incrassate lateral walls, alar group reddish, conspicuous, median and upper cells obliquely linear-rhomboidal, incrassate. Seta 6–8 mm. long, scabrous near tip; capsules elliptic, rough at base; calyptra fringed. (Fig. 22, D–H.)

Dept. Quiche: *Standley 62461*. Dept. Huehuetenango: *Standley 62586*. Dept. Quezaltenango: *Standley 66393* in part, *66406* in part. Dept. Chimaltenango: *Standley 61676, 64361*.

Distribution: Mexico, Costa Rica, West Indies, South America.

On damp, shaded banks at medium to high altitudes. This is a plastic species. The basal cells in the local plants are often shorter than in typical plants from Guadeloupe and the leaves of the sterile stems frequently concolorous at the tips although some plants invariably show the characteristic hyaline hair points.

6. ATRACTYLOCARPUS Mitt., Journ. Linn. Soc. **12**: 71. 1869.

Autoicous; stems radiculose, densely tufted. Leaves crowded, curved or secund, setaceous pointed from a lanceolate base, serrulate above; costa long excurrent, with two stereid bands; basal cells rectangular, alar group pale, fragile, not auriculate. Seta straight or slightly flexuous, elongate; capsule erect; peristome teeth divided nearly to base, striolate below; lid long beaked; calyptra long, cucullate, not fringed.

Annulus present, capsules cylindric.....2. *A. costaricensis*
Annulus lacking, capsules oblong.....1. *A. longisetus*

1. ATRACTYLOCARPUS LONGISETUS (Hook.) Bartr., Bryol. **49**: 110. 1946.

Dicranum longisetum Hook., Musc. Exot. tab. 139. 1820.
Dicranum sublongisetum C. M., Bull. Herb. Boiss. **5**: 185. 1897.

Plants brownish to yellow, not glossy. Stems 2–3 cm. long or longer, often branched. Leaves erect or slightly falcate-secund, 6–11 mm. long, from a short ovate base, long setaceous pointed, serrulate far below apex; costa wide below, long excurrent; basal

cells rectangular, alar group fugacious, upper cells linear. Seta 15–25 mm. long, straight or slightly flexuous; capsule oblong, urn 2 mm. long, lightly ribbed when dry; annulus lacking; peristome teeth reddish, divided more than half way down and perforate below; lid long and slenderly beaked; calyptra entire at base. (Fig. 23, A–C.)

Chemal: *Bernoulli & Cario 99.*

Distribution: Costa Rica, Panama, northern South America.

I have seen no plants of this species from Guatemala but *D. sublongisetum* C. M. is evidently the same thing.

2. ATRACTYLOCARPUS COSTARICENSIS (C. M.) Bartr., Bryol. **49**: 110. 1946.

Leptotrichum costaricense C. M., Bot. Zeit. **16**: 161. 1858.

Atractylocarpus mexicanus Mitt., Journ. Linn. Soc. **12**: 71. 1869.

Plants similar to *A. longisetus* but smaller. Leaves 5–7 mm. long, pale yellow, slightly secund. Capsule narrowly cylindric, smooth, urn 2–3 mm. long; annulus wide; peristome teeth divided nearly to base, forks slender, papillose; lid dark red, 1.5 mm. long; calyptra often reaching nearly to base of capsule, entire at base. (Fig. 23, D–F.)

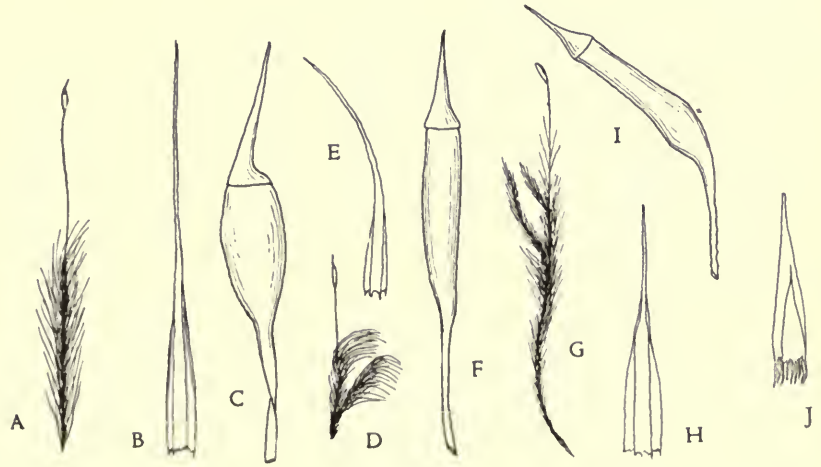

FIGURE 23

A–C, *Atractylocarpus longisetus:* A, plant, ×1; B, leaf, ×6; C, capsule, ×8. D–F, *Atractylocarpus costaricensis:* D, plant, ×1; E, leaf, ×6; F, capsule, ×8. G–J, *Pilopogon gracilis:* G, plant, ×1; H, leaf, ×6; I, capsule, ×8; J, calyptra, ×8.

Dept. Baja Verapaz: *Standley 69841* in part. Dept. Quiche: *Standley 62368*. Dept. Huehuetenango: *Standley 81365*. Dept. Totonicapan: *Standley 84535*. Dept. Sacatepequez: *Standley 65223a*. Dept. Chimaltenango: *Standley 57827a*. Dept. El Progresso: *Steyermark 43436*. Dept. Jalapa: *Steyermark 32493*.

Distribution: Mexico, Honduras, Costa Rica.

On logs and banks mostly at high altitudes. A frequent species confined to Mexico and Central America as far as known.

7. PILOPOGON Brid., Bryol. Univ. **1**: 519. 1826.

Dioicous; slender plants in dense tufts. Stems branched. Leaves erect, subulate-acuminate; costa broad with dorsal and ventral stereid bands; basal cells rectangular, lacking a distinct alar group. Perichaetial leaves long, convolute; seta elongate, erect; capsule cylindric, curved; peristome teeth not divided, papillose; annulus lacking; calyptra fringed at base.

1. PILOPOGON GRACILIS (Hook.) Brid., Bryol. Univ. **1**: 519. 1826.

Didymodon gracile Hook., Musc. Exot. tab. 5. 1818.

Pilopogon gracilis var. *Bernoullii* C. M., Bull. Herb. Boiss. **5**: 185. 1897.

Pilopogon glabrisetus C. M., Bull. Herb. Boiss. **5**: 551. 1897.

Yellowish green, glossy plants. Stems to 6 cm. or more long, radiculose, uniformly foliate. Leaves 6 mm. long, gradually subulate from a narrowly oblong base, denticulate near apex; costa short excurrent; basal cells thin walled, rectangular, gradually becoming shorter and irregular above. Perichaetial leaves with long, setaceous points often reaching the capsule; seta 1.5–2 cm. long, slender, slightly rough above; capsule smooth, dark brown, urn 2–2.5 mm. long; peristome teeth slender, papillose, entire; lid conic-rostrate; annulus lacking; calyptra long, fringed at base. (Fig. 23, G–J.)

Dept. San Marcos: *Standley 86195, 86444, 86511, 86515*. Dept. Quezaltenango: *Standley 85686*.

Distribution: Mexico, Costa Rica, West Indies, South America.

On damp banks and trees mostly at high altitudes. Readily distinguished from the allied genera by the conspicuous perichaetial leaves, the curved, cylindrical capsules and the undivided peristome teeth.

8. DICRANODONTIUM Bry. Eur. fasc. **41**. 1847.

Dioicous; stems slender, tomentose, simple or branched. Leaves slightly falcate-secund, long setaceous pointed from an ovate base;

costa broad below, long excurrent, with dorsal and ventral stereid bands; basal cells rectangular, slightly pitted, narrower toward margins, upper cells linear. Seta curved when moist; capsules erect, oblong; annulus lacking; peristome teeth divided more than half way down, vertically striolate below; lid rostrate; calyptra entire at base.

1. DICRANODONTIUM DENUDATUM (Brid.) E. G. Britt., No. Amer. Flora **15**[2]: 151. 1913.

Dicranum denudatum Brid., Musc. Rec. Suppl. **1**: 184. 1806.

Rather robust, pale green plants. Stems 5 cm. or more long, uniformly foliate. Leaves falcate-secund, 6–10 mm. long, from a short, ovate, concave base gradually long setaceous pointed, serrulate above; costa excurrent; basal cells laxly rectangular toward costa, much narrower toward margins, upper cells linear. Seta 1 cm. long, curved or cygneous when moist; capsule smooth; peristome teeth divided nearly to base; calyptra long. (Fig. 24, A–C.)

Dept. Chiquimula: *Steyermark 31000.*

Distribution: Eastern United States, Alaska, Mexico, Europe.

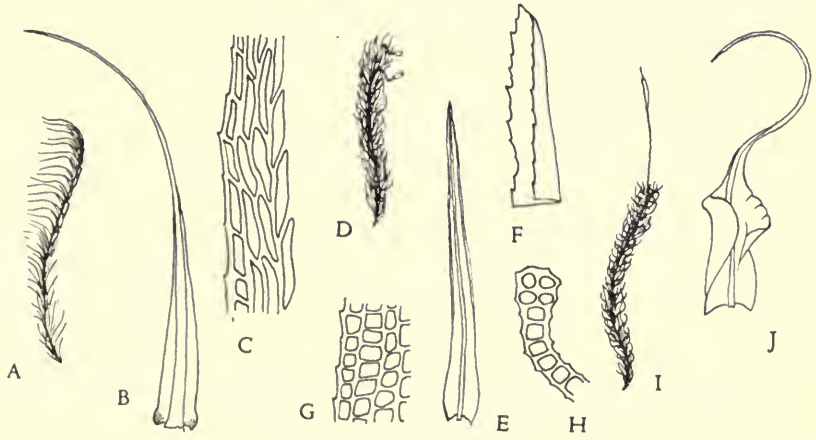

FIGURE 24

A–C, *Dicranodontium denudatum:* A, plant, ×1; B, leaf, ×6; C, upper leaf cells and margin, ×270.

D–H, *Oncophorus guatemalensis:* D, plant, ×1; E, leaf, ×8; F, apex of leaf, ×110; G, upper leaf cells and margin, ×270; H, part of cross section of leaf margin, ×270.

I–J, *Symblepharis helicophylla:* I, plant, ×1; J, leaf, ×8.

On damp ground in cloud forest. These plants are more robust than usual but this may be due to the excess of moisture. In other respects the shape and structure of the leaves are typical.

9. BROTHERA C. M., Gen. Musc. 258. 1901.

Small yellowish green plants, slightly glossy, in dense mats. Stems short, sparingly radiculose. Leaves crowded, subulate-acuminate from a lanceolate base, subtubulose; costa broad, excurrent, without stereids; lamina cells rectangular, hyaline. Seta erect, slender; capsule erect, oblong-ovoid; peristome single, teeth cleft to base into two subulate, papillose forks; lid rostrate; calyptra cucullate, fringed at base.

1. BROTHERA LEANA (Sull.) C. M., Gen. Musc. 259. 1901.

Campylopus Leana Sull., A. Gray Man. Ed. 2: 619. 1856.

Stems short, branched, less than 5 mm. high, usually with apical clusters of rudimentary leaves which serve the purpose of vegetative reproduction. Leaves flexuous when dry, to 2.5 mm. long, entire or minutely toothed at apex; margins erect or inflexed; costa 60 μ wide below, poorly defined, excurrent, in cross section showing a median row of chlorophyllose cells with bands of lax, hyaline cells on both sides; cells of leaf base rectangular, at basal angles lax and delicate forming small, poorly defined auricles. The local plants are sterile. (Fig. 25, A–C.)

Dept. Huehuetenango: *Sharp 4939a.* Dept. Quezaltenango: *Sharp 1995.*

Distribution: Pennsylvania, Ohio, Tennessee, Minnesota, Mexico, also Asia.

On banks and peaty soil at moderately high altitudes. The plants in both of these collections consist almost entirely of the deciduous brood leaves and are so deformed that it is difficult to find a normal leaf.

10. AMPHIDIUM (Nees) Schimp. emend. Bry. Eur. Coroll. 39. 1856.

Densely tufted plants, olive green above, brown below. Stems slender, sparingly radiculose. Leaves strongly crisped when dry, linear-lanceolate, costate to apex; upper leaf cells rounded-quadrate, papillose, basal cells narrowly rectangular, pellucid. Seta short; capsule barely exserted, strongly 8 ribbed, contracted below mouth

and urceolate when dry; peristome none; lid obliquely rostellate from a convex base; calyptra cucullate, naked.

1. AMPHIDIUM CYATHICARPUM (Mont.) Broth., E. & P. Nat. Pflanzenf. 1^3: 460. 1902.

Zygodon cyathicarpus Mont., Ann. Sci. Nat. 106. 1845.

Autoicous; stems under 1 cm. high, sparingly branched. Leaves crispate when dry, flexuous-spreading when moist, linear-lanceolate, acuminate; margins narrowly recurved near shoulders of leaf, plane above, distantly and shallowly toothed or notched in upper half; costa pale, distinct, ending in or just below the sharp apex; upper cells rounded-quadrate, diam. 8–10 μ, with firm pale walls, papillose, basal cells narrow, smooth, pellucid. Seta about 1 mm. long, often slightly curved; capsule oblong, wide-mouthed, with 8 brownish longitudinal ribs when dry; peristome none. (Fig. 25, D–E.)

Dept. Quezaltenango: *Sharp 2290.*

Distribution: Western South America, Hawaii, Australia, New Zealand, Africa.

On boulder at high altitude. The appearance of this austral species in Guatemala is exceedingly interesting. The only other locality I am aware of in the northern hemisphere is on the summit

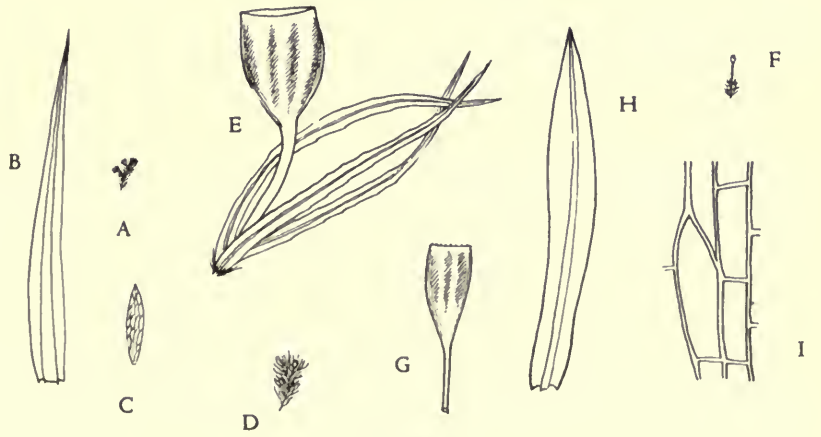

FIGURE 25

A–C, *Brothera Leana:* A, plant, ×1; B, leaf, ×22; C, abnormal leaf, ×22.
D–E, *Amphidium cyathicarpum:* D, plant, ×1; E, capsule and upper leaves, ×14.
F–I, *Rhabdoweisia fugax* var. *tenerrima:* F, plant, ×1; G, capsule, ×26; H, leaf, ×20; I, basal leaf cells, ×368.

of Haleakala, Maui, Hawaii. As far as I can see the Guatemalan plants are typical in every respect. The inflorescence is autoicous and the narrow leaves show the upper margins shallowly toothed or sinuate. As the plants are well fruited I think there can be little doubt regarding the accuracy of the determination.

11. RHABDOWEISIA Bry. Eur. fasc. **33–36.** 1846.

Small plants growing in extensive green mats. Leaves strongly curled when dry, narrowly linear-lanceolate, acuminate; costa ending near apex; upper leaf cells rounded-quadrate, chlorophyllose, smooth, basal cells rectangular, hyaline. Seta erect; capsule exserted, ovoid, 8 ribbed when dry; peristome well developed but fragile; lid rostrate.

1. RHABDOWEISIA FUGAX (Hedw.) Bry. Eur. var. TENERRIMA Bartr., Bryol. **50**: 203. 1947.

Low, delicate plants, laxly tufted. Stems 2–3 mm. high. Leaves crispate when dry, to 2 mm. long, linear-lanceolate, acuminate; margins plane, minutely crenulate above; costa ending just below apex; upper cells rounded-quadrate, diam. 8–10 μ, often transversely elongate, smooth, basal cells rectangular, delicate, thin-walled and hyaline, to 60 μ long, 12 μ wide. Seta erect, yellow, 2 mm. long; capsule erect, ovoid, 0.5 mm. long, 8 ribbed and urceolate when dry; peristome teeth very fragile, to 150 μ long, filiform from a short, broad base; spores pale, diam. 10–12 μ. (Fig. 25, F–I.)

Dept. San Marcos: *Sharp 5413a.* Dept. Quezaltenango: *Sharp 5035.*

Endemic.

Moist bank and decaying log at high altitudes. These plants are appreciably smaller and more delicate than any European specimens I have seen. The stems are only 2–3 mm. high, the leaves up to 2 mm. long and the basal leaf cells thin-walled hyaline and about 60 μ long changing abruptly to the short chlorophyllose cells above. In most cases only the expanded bases of the peristome teeth are evident, the fragile, filiform tips being almost invariably broken off in operculate capsules, but these vestiges will at once distinguish the plants from *Amphidium cyathicarpum* to which they bear a close resemblance.

12. ONCOPHORUS Brid., Bryol. Univ. **1**: 389. 1826.

Autoicous; dull yellowish green plants in dense tufts. Stems often branched. Leaves crisped when dry, lanceolate, usually serrate

above; margins recurved, bistratose; costa subpercurrent, with dorsal and ventral stereid bands; upper cells small, basal cells rectangular. Seta elongate, curved when moist; capsule nodding, sulcate; peristome teeth divided to middle; lid obliquely rostrate; calyptra cucullate.

1. ONCOPHORUS GUATEMALENSIS Bartr., Bryol. **49**: 111. 1946.

Densely tufted plants, dull yellowish green above, brown below. Stems 2–3 cm. long, simple or branched, sparingly radiculose below. Leaves crisped when dry, erect-spreading when moist, 5–6 mm. long, narrowly lanceolate, acute, keeled above; margins recurved below, irregularly serrate above, usually bistratose; costa stout, ending just below the acute apex; upper cells rounded-quadrate, lightly mammillose on both sides; inner basal cells narrowly rectangular, wider and more lax toward margins at the basal angles. Seta 3–4 mm. long, stout, yellowish, erect-flexuous when dry, strongly curved or cygneous when moist; capsule oblong-cylindrical, suberect, urn 1.5 mm. long, strongly ribbed when dry; annulus lacking; lid obliquely conic-rostrate, 0.75 mm. long; peristome teeth reddish, vertically striolate on outer plates below, cleft about half way down, forks papillose above; calyptra cucullate; spores papillose, diam. 15–18 μ. (Fig. 24, D–H.)

Dept. Quezaltenango: Uppermost ridge to summit of Volcan Zunil, alt. 3,000–3,800 m., *Steyermark 34869c, 34872.*

Endemic.

On dry slopes below summit. A clean cut species characterized by the short, cygneous setae. The genus has not been recorded before in North America south of the United States; hence these noteworthy collections have an added interest.

13. SYMBLEPHARIS Mont., Ann. Sci. Nat. II. **8**: 252. 1837.

Autoicous; medium sized plants in compact tufts. Stems erect, densely foliate. Leaves abruptly linear-lanceolate from an obovate, clasping base, the points widely spreading and crispate when dry; costa excurrent; basal cells rectangular, upper cells small and dense. Setae single or aggregated, elongate; capsule cylindrical, erect; peristome teeth divided to below middle; lid obliquely rostrate; calyptra entire at base.

1. SYMBLEPHARIS HELICOPHYLLA Mont., Ann. Sci. Nat. II. 8: 252. 1837.

Stems about 3 cm. high. Leaves 6–7 mm. long, from a strongly clasping obovate base about 2 mm. high quickly narrowed to a spreading, grooved, subulate point, distantly denticulate above; margins erect; costa slender, excurrent; cells smooth, narrowly rectangular, thin walled and hyaline in base, irregularly subquadrate with firm walls above. Setae 10–12 mm. long, straight; capsule smooth, erect, 3–4 mm. long; peristome teeth red, deeply divided, vertically striolate; lid about 0.8 mm. long; calyptra extending half way down urn. (Fig. 24, I–J.)

Dept. Huehuetenango: *Standley 81653, 81804, 81813.* Dept. Quezaltenango: *Steyermark 34116, 34724a, 34725a, 34869a; Standley 67656, 67679.* Dept. Chimaltenango: *Standley 58774, 60949a, 60960.*

Distribution: New Mexico, southern Arizona, Mexico, Costa Rica, Panama, Asia.

On trees, logs and moist banks at high altitudes. The abruptly spreading, strongly curled leaf points and the slender, erect, cylindrical capsules, deep red at mouth, are very characteristic. The plants fruit abundantly throughout their range.

14. DICRANOWEISIA Lindb., Oefv. Sv. Vet.-Akad. Forh. **21**: 230. 1864.

Tufted plants with erect, branching stems. Leaves flexuous or crispate, subulate pointed from an ovate base, entire; costa short excurrent; cells smooth, small and subquadrate above, rectangular below. Seta erect, elongate; capsules suberect; peristome teeth papillose, entire or cleft at apex.

1. DICRANOWEISIA CALCAREA Bartr., Bryol. **49**: 111. 1946.

Dioicous; plants densely tufted, dull brownish yellow. Stems 2–3 cm. high, encrusted with a calcareous deposit, laxly foliate. Leaves erect-flexuous, 2.5–3 mm. long, entire, rather abruptly subulate-acuminate from a short, ovate, concave, decurrent base; margins erect or slightly recurved on one side below; costa strong, short excurrent; cells smooth, incrassate, rectangular below and linear toward margins, irregularly subquadrate to elongate above, 10 μ wide, 12–25 μ long, the marginal rows smaller. Seta erect, smooth, 8–10 mm. long; capsules inclined, urn dark brown, 1.5 mm. long,

asymmetrical with a short neck; peristome none as seen (capsules all old and overripe). (Fig. 26, A–C.)

Dept. Huehuetenango: Above San Juan Ixcoy, Sierra de los Cuchumatanes, alt. 2,400 m., *Steyermark 50001*, TYPE.

Endemic.

On dripping rock at base of waterfall on encrusted limestone in forested ravine. This species is included in *Dicranoweisia* with considerable reservation. It has some affinities with *Hymenolopsis tolucensis* Thér. of Mexico but appears to be quite distinct in the decurrent leaf angles and the lack of differentiated alar cells. Until the peristome characters are known it seems wiser to follow the more conservative plan.

15. HOLOMITRIUM Brid., Bryol. Univ. 1: 226. 1826.

Plants medium sized, tufted. Stems branched, tomentose, often with terminal clusters of short, microphyllous branchlets. Leaves crowded, narrowly lanceolate from a broader base, crisped when dry; basal cells linear, alar group conspicuous, upper cells rectangular to subquadrate, incrassate; costa percurrent. Inner perichaetial leaves convolute, with long, setaceous points, often reaching the

FIGURE 26

A–C, *Dicranoweisia calcarea:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270.

D–E, *Holomitrium flexuosum:* D, plant, ×1; E, leaf, ×8.

F–H, *Holomitrium falcatum:* F, plant, ×1; G, leaf, ×8; H, upper leaf cells, ×270.

capsule. Seta erect; capsules erect, cylindrical; peristome teeth red, papillose, usually split along median line.

1. Leaves subentire, seta 5 mm. long ..... 6. *H. pulchellum*
   Leaves serrate or serrulate, seta 1 cm. or more long 2
2. Leaves spreading from insertion, serrulate above 3
   Leaves with an erect, clasping base, serrate half way down 5
3. Leaves strongly falcate-secund, 3–4 mm. long ..... 2. *H. falcatum*
   Leaves not falcate-secund, 5 mm. or more long 4
4. Alar cells conspicuous, forming a group about 200 μ high ..... 1. *H. flexuosum*
   Alar cells inconspicuous, forming a band less than 100 μ high .. 3. *H. terebellatum*
5. Upper leaf cells quadrate ..... 4. *H. arboreum*
   Upper leaf cells elongate, 1:4 or 5 ..... 5. *H. Standleyi*

1. HOLOMITRIUM FLEXUOSUM Mitt., Journ. Linn. Soc. **12**: 57. 1869.

Stems 4 cm. or more high, yellowish green above, brown below. Leaves spreading on all sides, 5 mm. or more long, narrowly lanceolate from an oblong base, grooved above, serrulate toward apex; costa excurrent, toothed on back above; upper cells rectangular, shorter at margins, basal cells narrowly rectangular, pitted, all smooth and incrassate, alar group prominent, extending nearly to costa. Sporophyte not seen. (Fig. 26, D–E.)

Dept. Huehuetenango: *Standley 81822*.

Distribution: Mexico, Costa Rica, Ecuador.

On tree in Juniperus forest at high altitude. These plants are undersize but in other respects agree with the species.

2. HOLOMITRIUM FALCATUM Bartr., Bryol. **49**: 111. 1946.

Near *H. flexuosum* Mitt. but apparently distinct in the shorter stems and smaller leaves, 3–4 mm. long (5–10 mm. long in *H. flexuosum*), which are conspicuously falcate-secund both moist and dry giving the plant a very characteristic appearance. (Fig. 26, F–H.)

Dept. Totonicapan: Near Cumbre del Aire, on road between Huehuetenango and Sija, alt. 3,000–3,450 m., *Standley 65906*.

Endemic.

The distinctions outlined above are not very impressive and unless they can be correlated with some sharper differences in the sporophyte it may be desirable to reduce *H. falcatum* to a variety of *H. flexuosum*.

3. HOLOMITRIUM TEREBELLATUM C. M., in Ren. & Card. Bull. Soc. Bot. Belg. **31**[1]: 151. 1893.

Robust plants forming deep tufts, yellowish green above, brown below. Stems to 5 cm. or more high, branched, densely foliate, clothed with reddish tomentum. Leaves widely spreading from the insertion, flexuous with strongly curled points when dry, 5–6 mm. long, gradually narrowed from an oblong, concave, entire base to a narrow, lanceolate, grooved point, acuminate; margins erect, undulate above, distantly and irregularly toothed down to leaf shoulders; costa excurrent. Toothed on back near apex; upper cells subquadrate to short rectangular, smooth, incrassate, gradually becoming narrowly linear and porose below, alar group very fragile and inconspicuous, forming a poorly defined band across base of leaf less than 100 μ high. (Fig. 27, A–C.)

Dept. Baja Verapaz: *Sharp 2759.*

Distribution: Costa Rica.

On tree trunk at moderate altitude. Previously considered a Costa Rican endemic where it is decidedly uncommon. The Guatemalan plants lack fruit and are undersized but the essential characters leave little doubt as to its identity.

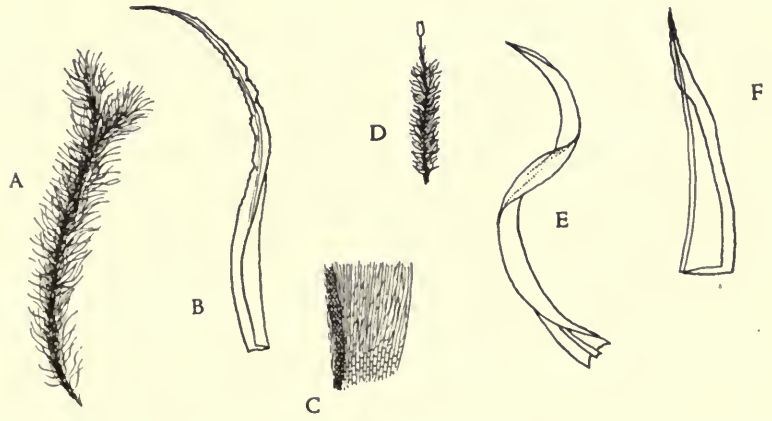

FIGURE 27

A–C, *Holomitrium terebellatum:* A, plant, ×1; B, leaf, ×8; C, one side of leaf base, ×68.

D–F, *Holomitrium pulchellum:* D, plant, ×1; E, leaf, ×20; F, apex of leaf, ×66.

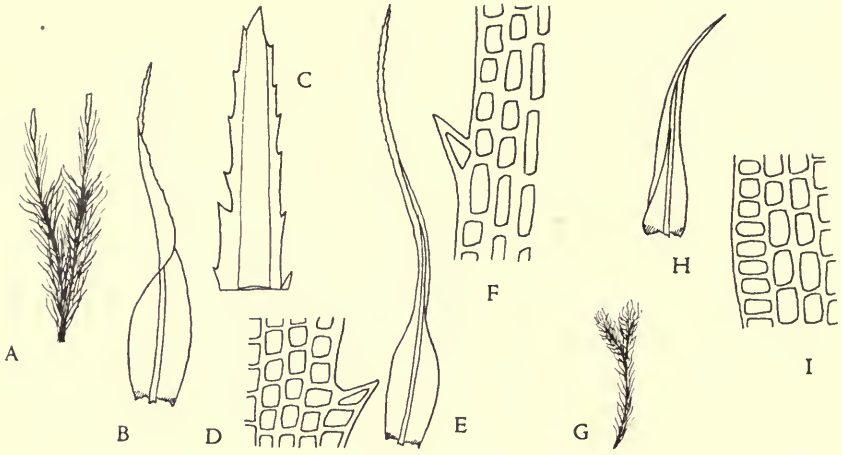

FIGURE 28

A–D, *Holomitrium arboreum:* A, plant, ×1; B, leaf, ×8; C, apex of leaf, ×110; D, upper leaf cells and margin, ×270.

E–F, *Holomitrium Standleyi:* E, leaf, ×8; F, upper leaf cells and margin, ×270.

G–I, *Dicranum flagellare:* G, plant, ×1; H, leaf, ×8; I, upper leaf cells and margin, ×270.

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4. HOLOMITRIUM ARBOREUM Mitt., Journ. Linn. Soc. **12**: 58. 1869.

Stems 2–3 cm. high, yellowish green, brown below. Leaves crowded, strongly crisped when dry, 4–6 mm. long, linear-lanceolate from an erect, ovate, clasping base, strongly serrate above middle; costa percurrent; upper cells subquadrate, basal cells linear, incrassate, pitted, alar group distinct. Tips of perichaetial leaves often reaching the capsule. Seta 1–1.5 cm. long; capsule cylindric, urn 4–5 mm. long; lid subulate-rostrate. (Fig. 28, A–D.)

Dept. Peten: *Lundell 2679* (as *H. calycinum*). Dept. Jalapa: *Steyermark 32552* (as *H. calycinum*), *33114* (as *H. calycinum*).

Distribution: Mexico to Bolivia.

On trees and rocks at moderate altitudes. The short upper leaf cells often wider than long and in one layer throughout will separate this species from any of its local allies.

5. HOLOMITRIUM STANDLEYI Bartr., Contr. U. S. Nat. Mus. **26**[3]: 66. 1928.

Plants similar in habit and appearance to *H. arboreum* but with the upper and median leaf cells elongate especially toward costa

where they are often 4–5 times as long as wide with sinuous lateral walls. (Fig. 28, E–F.)

Dept. Alta Verapaz: *Standley 91596.*

Distribution: Costa Rica.

On limestone at moderate altitude. In this species the leaf cells are not all elongate but the areolation is quite different from that of *H. arboreum.* The distinction is none too marked however and a broader series of specimens might show that they are not wide enough apart for practical segregation.

6. HOLOMITRIUM PULCHELLUM Mitt., Journ. Linn. Soc. **12**: 60. 1869.

Forming dense, compact cushions, yellowish green above, brown below. Stems to 2 cm. high, branched, tomentose. Leaves crowded, very crispate when dry, flexuous-spreading when moist, 2–2.5 mm. long, gradually lanceolate from an ovate, slightly clasping base, acuminate, canaliculate; margins erect, entire or minutely toothed at extreme apex; costa short-excurrent; upper leaf cells rounded, strongly incrassate, smooth, diam. 5–7 μ, basal cells narrowly rectangular with firm, pale walls. Perichaetium about half as long as the seta, leaves convolute with spreading points; seta erect, yellow, 5 mm. long; capsule erect, oblong, urn 1.5 mm. long. (Fig. 27, D–F.)

Dept. Quezaltenango: *Sharp 2199a.*

Distribution: Ecuador.

On tree at moderately high altitude. This is evidently a very rare species. It is represented in the Mitten Herbarium by only one collection from the type locality in Ecuador.

Compact cushions of tightly curled leaves studded with attractively colored, short-stalked capsules standing well above the conspicuous perichaetia give these plants an especially neat and trim look. As Mitten aptly remarks it is "a very pretty moss." The short setae and nearly entire leaves are unique characters among the American species of Holomitrium. It is a striking addition to the North American moss flora.

16. DICRANUM Hedw., Sp. Musc. 126. 1801.

Dioicous; medium sized to robust plants. Leaves lanceolate, often falcate-secund; costa narrow but strong, with dorsal and ventral stereid bands, often toothed on back; leaf cells mostly smooth, alar group inflated, usually colored and conspicuous. Seta erect;

capsules cylindrical, erect or curved; peristome teeth red, vertically striolate, cleft about half way down; lid long beaked; calyptra cucullate, entire at base.

1. Upper leaf cells small, subquadrate.....1. *D. flagellare*
   Upper leaf cells elongate, pitted.....2
2. Leaves short pointed, costa not winged on back.....2. *D. rhabdocarpum*
   Leaves long acuminate, costa winged on back.....3. *D. frigidum*

1. DICRANUM FLAGELLARE Hedw., Sp. Musc. 130. 1801.

Plants yellowish green, tufted; stems 1–3 cm. high, often with fragile, microphyllous branchlets in axils of upper leaves. Leaves 3–3.5 mm. long, crispate when dry, lanceolate; margins erect, inflexed above, toothed near apex; costa percurrent; upper cells quadrate or short rectangular, basal cells rectangular with firm, pellucid walls, alar group colored, conspicuous. Seta 1–2 cm. long; capsules cylindric, erect. (Fig. 28, G–I.)

Dept. Huehuetenango: *Standley 81705, 81804a.*

Distribution: Southern Canada, United States, Mexico, Europe, Asia.

On logs and limestone at high altitudes. The characteristic flagellate branchlets are very scarce in these two local collections but in other particulars the plants are typical.

2. DICRANUM RHABDOCARPUM Sull., Mem. Am. Acad. II. 4: 172. 1849.

Pale or yellowish green glossy plants. Stems 1–2 cm. or more long. Leaves crowded, suberect and nearly straight when dry, 3–5 mm. long, ovate-lanceolate, serrulate above, acute; costa ending below apex, toothed on back above; basal cells rectangular, alar group inflated and colored, upper cells elongate, incrassate, pitted. Seta 1.5–2 cm. long; capsules cylindric, erect. (Fig. 29, A–D.)

Dept. Quezaltenango: *Standley 67694a, 67743, 67744a, 67749a.*

Distribution: Mountains of Colorado, new Mexico and Arizona, Mexico.

On rocks and banks at high altitudes. These collections are small, underdeveloped and sterile but there is little doubt concerning their identity.

3. DICRANUM FRIGIDUM C. M., Bot. Zeit. **17**: 219. 1859.

Robust plants in extensive deep mats, yellowish green and lustrous above, brown below. Stems to 10 cm. or more long, tomentose. Leaves spreading, flexuous or falcate-secund, scarcely undulate, linear-lanceolate from an ovate base, serrate in upper half, 10–13 mm. long; costa ending below apex, with two sharply serrated wings on back; cells all elongate with thickened, pitted walls, alar group brown. Setae aggregated, 1–3, red, to 5 cm. long; capsule cylindric, curved, urn 4–5 mm. long. (Fig. 29, E–H.)

Dept. Quiche: *Aguilar 1115*. Dept. Huehuetenango: *Steyermark 50173, 51901*. Dept. Zacapa: *Steyermark 43290*.

Distribution: Mexico to northern South America.

On damp ground at high altitudes. Near *D. rugosum* (Hoffm.) Brid. but uniformly distinct in the longer, scarcely undulate leaves, longer setae and longer capsules.

17. LEUCOLOMA Brid., Bryol. Univ. **2**: 218. 1827.

Dioicous; pale green, silky plants in soft, loose tufts. Stems branched, sparsely radiculose. Leaves flexuous or secund, gradually subulate-lanceolate from an ovate base; costa narrow; chlorophyllose

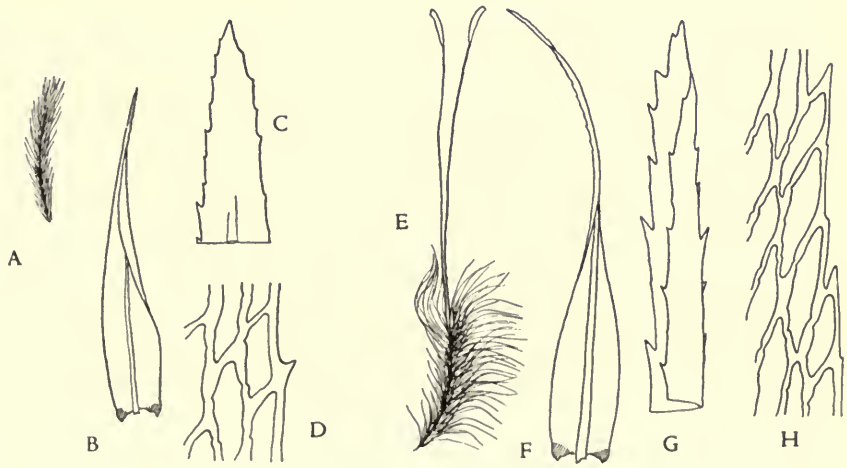

FIGURE 29

A–D, *Dicranum rhabdocarpum:* A, plant, ×1; B, leaf, ×8; C, apex of leaf, ×110; D, upper leaf cells and margin, ×270.

E–H, *Dicranum frigidum:* E, part of plant, ×1; F, leaf, ×6; G, apex of leaf, ×110; H, upper leaf cells and margin, ×270.

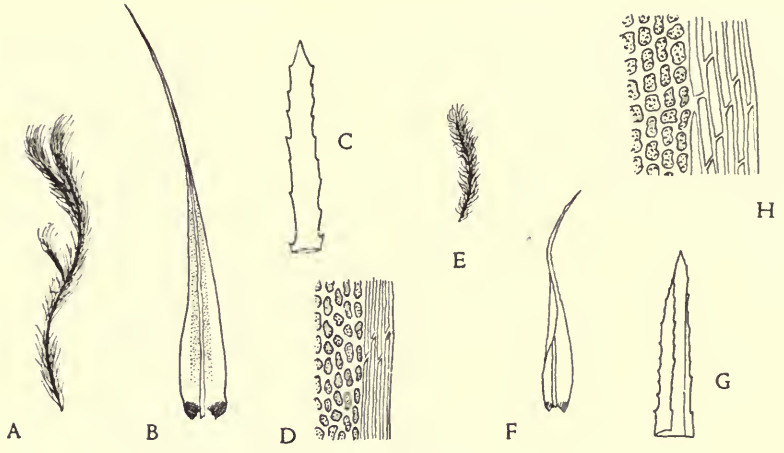

FIGURE 30

A–D, *Leucoloma serrulatum:* A, plant, ×1; B, leaf, ×8; C, apex of leaf, ×110; D, upper leaf cells and margin, ×270.

E–H, *Leucoloma Crugerianum:* E, plant, ×1; F, leaf, ×8; G, apex of leaf, ×110; H, cells and margin near mid-leaf, ×270.

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cells small, papillose, marginal cells smooth, narrow and hyaline forming a distinct border, alar group large, auriculate. Seta erect; capsules cylindric; peristome teeth divided to or below middle.

Leaves with a distinct median band of short, papillose cells extending to or near base.....1. *L. serrulatum*

Leaves without a median band of short cells in basal part.....2. *L. Crugerianum*

1. LEUCOLOMA SERRULATUM Brid., Bryol. Univ. **2:** 752. 1827.

Stems to 6 cm. or more long. Leaves 4–7 mm. long, straight or curved, narrowly subulate-acuminate, grooved above, serrulate toward apex; costa excurrent; marginal cells linear, hyaline, forming a distinct border merging with the basal cells below, chlorophyllose cells small, oblong, papillose on back, extending nearly to insertion in a broad, sharply defined median band. Sporophyte not seen. (Fig. 30, A–D.)

Dept. Izabal: *Steyermark 38805a, 39203, 41765.* Dept. Alta Verapaz: *Steyermark 45561, 45614, 45615, 46376; Standley 90639.* Dept. Quezaltenango: *Steyermark 34350.* Dept. Zacapa: *Steyermark 29827, 42789.* Dept. Chiquimula: *Steyermark 31030.*

Distribution: Mexico, Costa Rica, West Indies, British Guiana.

On logs and trees at low and medium altitudes. These collections are sterile as are all the numerous specimens in my herbarium but

the broad median band of green cells reaching nearly to the insertion is a distinctive feature.

2. LEUCOLOMA CRUGERIANUM (C. M.) Jaeg., Adumb. **1**: 116. 1872–73.

Dicranum Crugerianum C. M., Syn. 2: 588. 1851.

Stems short, fragile. Leaves narrowly lanceolate, subulate pointed, flexuous and widely spreading when dry, 3–5 mm. long, tubulose above, serrulate near apex; costa excurrent; border of linear cells one row wide above, gradually wider below and merging with the basal cells, green cells subquadrate, sharply papillose on back above, irregularly longer below where they merge with the basal cells. Sporophyte not seen. (Fig. 30, E–H.)

Dept. Peten: *Lundell 2840.* Dept. Quezaltenango: *Standley 84880.*

Distribution: Mexico, British Honduras, Costa Rica, West Indies, Venezuela.

On banks at low to medium altitudes. The narrower leaves, indistinctly bordered and without a well defined median band of green cells will distinguish this species from *L. serrulatum.*

7. LEUCOBRYACEAE

Compactly tufted, whitish green plants, leaves fragile, consisting mostly of a broad, thick costa showing in cross section a central row of small chlorophyllose cells (chlorocysts) covered on both sides by one or more layers of large hyaline cells (leucocysts), porose on the inner walls. Sporophyte as in Dicranaceae.

1. Capsules immersed, calyptra fringed at base.....1. *Ochrobryum*
   Capsules exserted, calyptra entire at base.....2
2. Capsules ovoid, inclined, asymmetrical.....3. *Leucobryum*
   Capsules cylindrical, erect, symmetrical.....2. *Octoblepharum*

1. OCHROBRYUM Mitt., Journ. Linn. Soc. **12**: 108. 1869.

Low, dull, whitish green plants forming dense tufts. Leaves erect to slightly spreading, crowded, rigid when moist, linear-lanceolate from a narrowly ovate base, subtubulose above, bluntly pointed, leucocysts in one layer on each side of the median row of chlorocysts; lamina cells narrowly rectangular, confined to basal part. Seta short, terminal; capsules immersed; peristome lacking; calyptra conic-rostrate, slender, fringed at base.

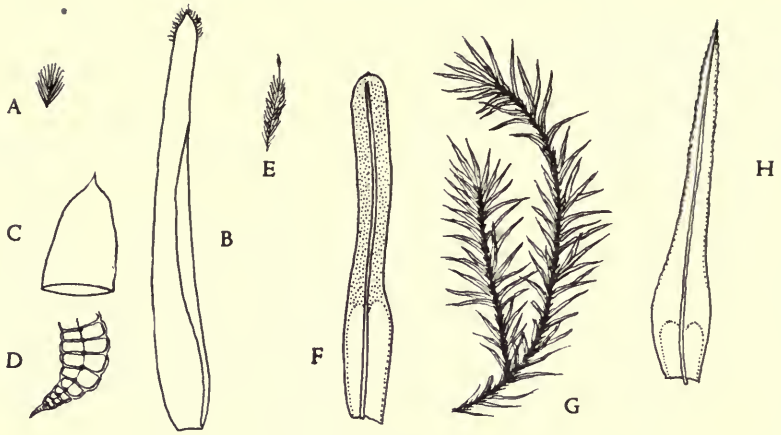

FIGURE 31

A–D, *Ochrobryum obtusifolium:* A, plant, ×1; B, leaf, ×18; C, apex of leaf, ×68; D, part of cross section of leaf, ×68.

E–F, *Syrrhopodon ligulatus:* E, plant, ×1; F, leaf, ×16.

G–H, *Syrrhopodon lycopodioides:* G, plant, ×1; H, leaf, ×6.

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1. OCHROBRYUM OBTUSIFOLIUM (C. M.) Mitt., Journ. Linn. Soc. **12:** 108. 1869.

Schistomitrium obtusifolium C. M., Bot. Zeit. 577. 1857.

Leaves 3–3.5 mm. long, obtuse or bluntly acute, often with brush-like clusters of brownish filaments on the dorsal face near apex which varies considerably from broadly rounded to acute but always with a minute apiculate point; margins erect or inflexed so that the blade is deeply grooved or subtubulose above; lamina cells thin-walled, hyaline, in 4–6 rows, evident only on the basal margins. (Fig. 31, A–D.)

Dept. Baja Verapaz: *Sharp 2660a.*

Distribution: Costa Rica, Colombia.

On decaying log at rather low altitude. The only other North American records of this rare little species are from Costa Rica where it was collected by Standley. Here as in Costa Rica the plants are characterized by conspicuous clusters of brownish septate filaments on the dorsal faces of the leaf tips.

Although quite similar in appearance to some of the smaller forms of *Leucobryum albidum* the lack of any expanded leaf base coupled with the leucocysts in two layers, one above and one below the median row of chlorocysts, cannot fail to distinguish it upon careful examination.

2. OCTOBLEPHARUM Hedw., Sp. Musc. 50. 1801.

Autoicous; whitish plants tinged with brown or red, growing in tufts or cushions. Leaves spreading, lingulate from a hyaline base, plane above, apiculate and serrulate at apex; costa with a median row of small, triangular chlorocysts and 3–4 layers of leucocysts on both sides; lamina small and narrow, confined to base. Seta erect; capsules erect, cylindrical; peristome teeth 8 or 16; calyptra cucullate, entire at base.

1. Leaves less than 10 mm. long 2
   Leaves 15–20 mm. long 3
2. Peristome teeth 8, leaves usually not fragile ..... 1. *O. albidum*
   Peristome teeth 16, leaves very fragile ..... 2. *O. pulvinatum*
3. Plants yellowish, leaf base oblong, tapering above ..... 3. *O. erectifolium*
   Plants purplish, leaf base obovate, rounded above ..... 4. *O. Mittenii*

1. OCTOBLEPHARUM ALBIDUM Hedw., Sp. Musc. 50. 1801.

Plants in dense cushions. Stems to 3 cm. high, branched. Leaves widely spreading or recurved, to 6 mm. or more long, oblong-lingulate from a slightly broader erect base, rounded, apiculate and serrulate at apex. Seta 4–7 mm. long; capsule oblong, 1–1.5 mm. long; peristome teeth 8, brown, faintly striolate; lid obliquely rostrate. (Fig. 32, A–D.)

Dept. Izabal: *H. Johnson 1046; Standley 72841; Steyermark 41830, 41831,* Dept. Baja Verapaz: *Standley 69770.* Dept. Retalhuleu: *Standley 88546.* Dept. Chiquimula: *Steyermark 31226.* Dept. Jalapa: *Standley 77411; Steyermark 32091.* Dept. Santa Rosa: *Standley 78030.*

Distribution: Pantropical, southern Florida.

On tree trunks. Mostly in the lowlands. The rather short, fleshy, strap-shaped leaves, not or rarely fragile will readily identify this common, widely distributed species.

2. OCTOBLEPHARUM PULVINATUM (Doz. & Molk.) Mitt., Journ. Linn. Soc. **12**: 109. 1869.

Arthrocormus pulvinatus Doz. & Molk., Fl. Bryol. Surinam 6. 1854.

Plants similar to *O. albidum* but with more erect, less fleshy and very fragile leaves. Seta 10 mm. or more long; capsules about 2 mm. long; peristome teeth 16, in 8 pairs, nearly smooth. (Fig. 32, E–G.)

Dept. Peten: *Lundell 2700, 2736a, 2769.* Dept. Izabal: *Steyermark 38738.*

Distribution: Costa Rica, British Honduras, West Indies, northern South America.

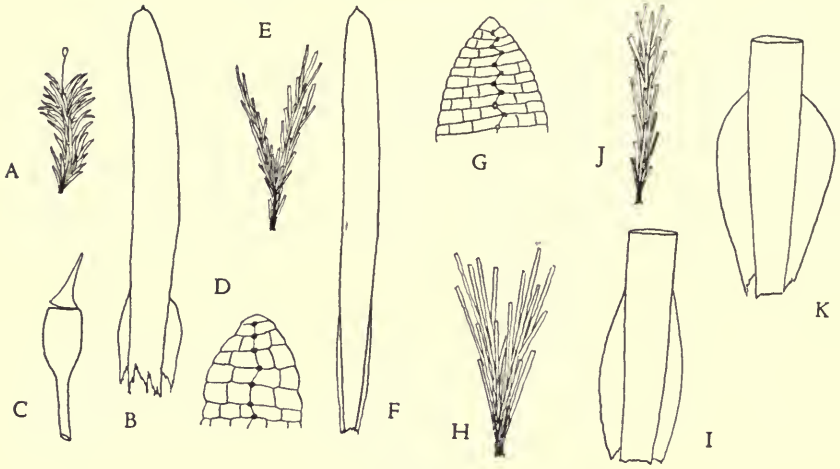

FIGURE 32

A–D, *Octoblepharum albidum:* A, plant; ×1; B, leaf, ×8; C, capsule, ×8; D, part of cross section of costa, ×110.

E–G, *Octoblepharum pulvinatum:* E, plant, ×1; F, leaf, ×8; G, part of cross section of costa, ×110.

H–I, *Octoblepharum erectifolium:* H, plant, ×1; I, leaf base, ×10.

J–K, *Octoblepharum Mittenii:* J, plant, ×1; K, leaf base, ×10.

On tree trunks at low altitudes. Although sterile these collections seem to meet all the requirements of *O. pulvinatum.*

3. OCTOBLEPHARUM ERECTIFOLIUM Mitt., No. Amer. Flora **15**[2]: 162. 1913.

Plants glossy, tinged with brown. Leaves erect, rigid, fragile, 1.5–2 cm. long, narrowly ligulate from a narrowly oblong base tapering at shoulders; apex acute, irregularly sinuate; lamina at leaf base narrow, tapering upward, 150–160 μ wide on each side of costa, inner cells 3–4 times as long as wide. Sporophyte unknown. (Fig. 32, H–I.)

Dept. Alta Verapaz: *Standley 91692.*

Distribution: Costa Rica, Jamaica, Trinidad.

On trees at moderate altitude. The coloring alone should separate this species from *O. Mittenii* but in addition there seem to be tangible differentiating characters in the shape and areolation of the leaf base.

4. OCTOBLEPHARUM MITTENII Jaeg., Adumb. **1**: 169. 1871–72.

Octoblepharum longifolium Mitt., Journ. Linn. Soc. **12**: 110. 1869.

Plants deeply tinged with purple, glossy with an iridescent sheen. Leaves fragile, 1.5 cm. or more long, narrowly ligulate from an obovate base, broadly rounded at shoulders, apex obtuse, apiculate; interior lamina cells short rectangular, about 40 μ wide and 1–2 times as long, thin walled, in two layers, narrowly linear-rhomboidal and in one layer toward margins. Sporophyte unknown. (Fig. 32, J–K.)

Dept. Alta Verapaz: *Standley 91700.*

Distribution: British Honduras, Costa Rica, Brazil.

On log at moderate altitude.

3. LEUCOBRYUM Hampe, Flora **20**: 282. 1837.

Whitish green plants in dense cushions. Leaves crowded, spreading or flexuous, from an ovate base narrowed to a subtubulose point, composed almost entirely of the costa, lamina reduced to a narrow hyaline margin below; in cross section showing a central row of small, angular chlorocysts with 1–4 layers of leucocysts on both sides. Seta elongate; capsules inclined; peristome dicranoid.

1. Leucocysts in 2 layers throughout the leaf.....4. *L. Martianum*
   Leucocysts in 4 or more layers in thickest part of leaf base..... 2
2. Leaves 5–10 mm. long, tip longer than base.....3. *L. antillarum*
   Leaves less than 5 mm. long, tubulose tip about equaling basal part..... 3
3. Leucocysts in 4 layers in thickest part of leaf.....1. *L. albidum*
   Leucocysts in 5–6 layers in thickest part of leaf.....2. *L. Polakowskyi*

1. LEUCOBRYUM ALBIDUM (Brid.) Lindb., Oefv. Sv. Vet.-Akad. Forh. **20**: 403. 1863.

Dicranum albidum Brid., Musc. Rec. 2[1]: 167. 1798 and Sp. Musc. 205. 1806.
Leucobryum incurvifolium C. M., Bull. Herb. Boiss. 5: 174. 1897.

Relatively small plants; stems 1–3 cm. high. Leaves crowded, imbricated when dry, to 4.5 mm. long, the subtubulose point shorter than or equal in length to the broad base, in cross section near base showing 2–3 layers of leucocysts on each side of the median row of chlorocysts in the thicker parts of leaf. Seta elongate, slender, red; capsule nodding, curved, ribbed when dry; lid beaked, about as long as urn. (Fig. 33, A–C.)

Dept. Alta Verapaz: *Standley 69121, 90630, 92207; Steyermark 44419, 45630.* Dept. Zacapa: *Steyermark 42230.*

Distribution: Eastern United States, Mexico, Costa Rica, Bahamas, West Indies.

On logs and soil at low to medium altitudes. Rather variable in development and scarcely distinct from the following species which will probably have to be included with it.

2. LEUCOBRYUM POLAKOWSKYI (C. M.) Card., Mem. Soc. Sci. Nat. Cherb. **32**: 82. 1900.

Ochrobryum Polakowskyi C. M., Besch. Journ. de Bot. **11**: 151. 1897.

The distinctions between this species and *L. albidum* are not impressive. Here the subtubulose leaf points are a little longer and the leucocysts in the thicker parts of the leaf base in about 3 layers on each side of the chlorocyst row but these differences are not always clearly correlated or maintained. (Fig. 33, D–E.)

Dept. Alta Verapaz: *Standley 90779, 91456.* Dept. San Marcos: *Steyermark 36675.* Dept. Solola: *Steyermark 47985.*

Distribution: Mexico, Costa Rica, Jamaica.

On logs and soil, mostly at medium altitudes.

3. LEUCOBRYUM ANTILLARUM Schimp., Besch. Ann. Sci. Nat. VI. **3**: 190. 1876.

Stems longer than in *L. albidum.* Leaves spreading, flexuous, 5–10 mm. long, the subtubulose part from slightly longer to 2 or 3 times as long as the leaf base, in cross section showing 2–3 layers of leucocysts on each side of the chlorocysts in the thicker parts of the base; hyaline lamina about 8 cells wide. (Fig. 33, F–G.)

Dept. Alta Verapaz: *Standley 92316, 92321.* Dept. Quezaltenango: *Steyermark 33839.*

Distribution: Florida, West Indies, Central and South America.

On logs and hummocks in swamps at moderate altitudes. This is not a very convincing species. The Florida plants as described and illustrated in Grout's Moss Flora of North America are certainly not typical and it is often difficult to see how *L. antillarum* differs from *L. glaucum* (Hedw.) Schimp.

4. LEUCOBRYUM MARTIANUM (Hornsch.) Hampe, Linnaea **17**: 317. 1843.

Dicranum Martianum Hornsch., Fl. Bras. **1**: 11. 1840.

Plants in lax mats; stems 1–2 cm. high. Leaves crowded, falcate-secund, 5–6 mm. long, gradually narrowed from an ovate base to slender, subtubulose point; leaf base not thickened, leucocysts in

a single layer on each side of the chlorocysts throughout the leaf, chlorocysts nearer the dorsal surface in upper part of leaf; hyaline lamina about 6 cells wide. Seta to 2 cm. long, red; capsules curved, ribbed when dry, strumose. (Fig. 34, A–C.)

Dept. Izabal: *Standley 72767.*

Distribution: Costa Rica, West Indies, northern South America.

On log at low altitude. The leaf structure showing the leucocysts in only 2 layers throughout is sharply distinctive.

8. CALYMPERACEAE

Small to fairly robust plants growing in tufts, mostly on trees. Leaves lanceolate from a pale sheathing base, often with a narrow hyaline border, more rarely unbordered or with thickened, concolorous margins; costa strong; upper cells small, usually papillose; inner basal cells abruptly large and hyaline (cancellinae). Seta erect, usually elongate; capsules erect, cylindrical; peristome of 16 papillose teeth or lacking; calyptra cucullate or campanulate.

Peristome present, calyptra cucullate.....1. *Syrrhopodon*
Peristome lacking, calyptra campanulate and persistent, leaves usually with an intramarginal border of elongated cells.....2. *Calymperes*

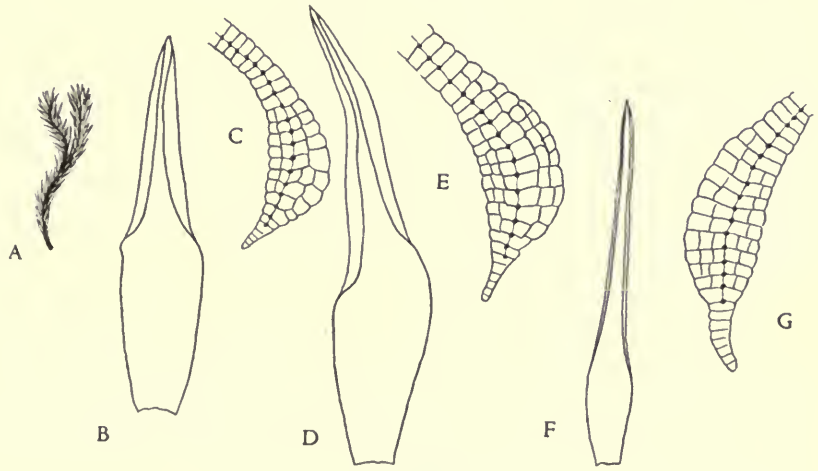

FIGURE 33

A–C, *Leucobryum albidum:* A, plant, ×1; B, leaf, ×12; C, part of cross section of leaf near base, ×68.

D–E, *Leucobryum Polakowskyi:* D, leaf, ×12; E, part of cross section of leaf near base, ×68.

F–G, *Leucobryum antillarum:* F, leaf, ×6; G, part of cross section of leaf near base, ×68.

1. SYRRHOPODON Schwaegr., Suppl. 2²: 110. 1824.

Plants green or brownish; stems branched. Leaves crowded, the whitish, imbricated bases often conspicuous, lanceolate or ligulate, with either a thickened or hyaline border; costa stout, subpercurrent, often spinose on one or both sides; upper cells small, changing abruptly to the large, hyaline cancellinae cells of the leaf base. Capsules cylindrical; peristome teeth 16, papillose; calyptra cucullate.

1. Leaves bordered with narrow, elongated cells 2
   Leaf border thickened, doubly serrate, marginal cells not differentiated 5
2. Robust plants, leaf margins spinose-serrate with paired teeth . 6. *S. lycopodioides*
   Small plants, leaves entire or nearly so 3
3. Leaves ligulate, apex rounded ..... 2. *S. ligulatus*
   Leaves lanceolate or linear, acute 4
4. Leaves long-pointed, bordered nearly to apex ..... 1. *S. prolifer*
   Leaves acute, unbordered in upper ½ ..... 5. *S. parasiticus*
5. Basal leaf cells reddish ..... 4. *S. Bernoullii*
   Basal leaf cells hyaline ..... 3. *S. incompletus*

1. SYRRHOPODON PROLIFER Schwaegr., Suppl. 2²: pt. 2, 99. 1827.

Plants fragile, pale or yellowish green; stems 1–2 cm. long, branched. Leaves crowded, flexuous when dry, 3–6 mm. long or longer, linear from a pale, oblong base, acute, sharply toothed near apex, otherwise entire, with a narrow hyaline border of elongated cells extending nearly to apex; costa ending below apex, spinose near tip; upper cells small, dense, papillose, obscure, cancellinae filling nearly all of the leaf base, in 2 layers, usually acutely angled above. Seta 5–8 mm. long; capsule cylindric, lid beaked; calyptra covering more than half the urn. (Fig. 34, D–F.)

Dept. Solola: *Steyermark 47986a.*

Distribution: Mexico, West Indies, Central and South America.

On rock at medium altitude. Just a few stems segregated from other mosses but enough for identification. It seems reasonably sure that *S. flavescens* C. M., including the list of synonyms given by Williams (33, p. 376), may be included here. The leaves vary considerably in length but little in structural details.

2. SYRRHOPODON LIGULATUS Mont., Syll. 47. 1856.

Small, brownish, brittle plants, densely tufted. Stems to 1 cm. high, branched, densely foliate. Leaves strongly curled when dry,

to 3 mm. long, ligulate from a scarcely wider oblong, pale, entire base, apex broadly rounded, often minutely apiculate, unbordered or with a single row of very narrow, hyaline, marginal cells here and there in the blade; costa ending below apex; upper cells papillose, obscure, diam. 6–8 μ, cancellinae in 4 or 5 rows, broadly rounded above, bordered by about 5 rows of linear, pellucid cells. Seta red, 3–4 mm. long; capsule cylindrical, dark brown, urn 1 mm. long; lid subulate-rostrate (Fig. 31, E–F.)

Dept. Baja Verapaz: *Sharp 2704.*

Distribution: Florida, West Indies, northern South America.

On tree at rather low altitude. Like *S. lycopodioides* this species is a representative Caribbean type extending from Florida through the West Indies to the Guianas but not recorded before from Central America.

3. SYRRHOPODON INCOMPLETUS Schwaegr., Suppl. 2[1]: 119. 1824.

Syrrhopodon decolorans C. M., Bull. Herb. Boiss. 5: 188. 1897.

Fairly robust, brownish green plants in deep tufts. Leaves crowded, 4–5 mm. long, abruptly broadly linear from a hyaline,

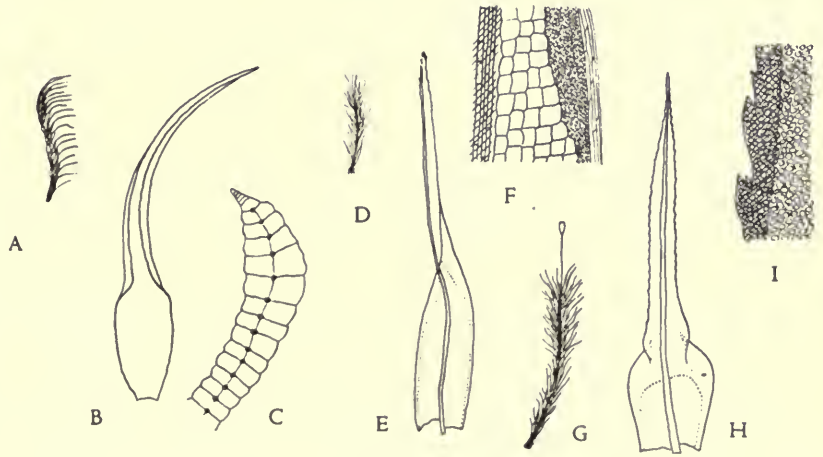

FIGURE 34

A–C, *Leucobryum Martianum:* A, plant, ×1; B, leaf, ×8; C, part of cross section of leaf near base, ×68.

D–F, *Syrrhopodon prolifer:* D, plant, ×1; E, leaf, ×14; F, upper leaf base and margin, ×110.

G–I, *Syrrhopodon incompletus:* G, plant, ×1; H, leaf, ×10; I, upper leaf margin, ×134.

obovate base, basal margins serrulate, margins of blade concolorous, thickened and doubly serrate, apex rounded and occasionally bearing clusters of propagula; costa nearly percurrent; upper cells subquadrate or longer than wide, cancellinae in 10–12 rows, rounded above. Seta 6–7 mm. long; capsule oblong, narrowed at mouth; peristome a short, pale cylinder not exceeding the rim. (Fig. 34, G–I.)

Dept. Peten: *Lundell 2035; Bartlett 12250, 12488.* Dept. Izabal: *Standley 72788.*

Distribution: Florida, Mexico, Honduras, British Honduras, Costa Rica, Panama, West Indies, northern South America.

On trees at low altitudes. A common Caribbean species easily known by the obovate, whitish leaf base and the thickened, winged margins of the leaf blade serrate on the edges.

4. SYRRHOPODON BERNOULLII C. M., Bull. Herb. Boiss. **5**: 189. 1897.

Brownish green plants growing in deep tufts; stems to 4–5 cm. high, branched. Leaves to 6–7 mm. long, linear-lanceolate from an oblong-ovate golden brown base; margins serrulate at base, thickened, concolorous and doubly serrate above; costa nearly percurrent; upper cells slightly elongate; cancellinae in numerous rows, not sharply defined, rounded above. Seta to 18 mm. long; capsule oblong, small mouthed; peristome teeth pale brown, coarsely papillose. (Fig. 35, A–C.)

Distribution: Nicaragua, Costa Rica, Panama, Guadeloupe, Cocos Island.

I have seen no Guatemalan collection and the species is evidently infrequent locally although widely but sparingly distributed elsewhere.

5. SYRRHOPODON PARASITICUS (Sw.) Besch., Ann. Sci. Nat. VIII. **1**: 298. 1895.

Encalypta parasitica Sw., Fl. Ind. Occ. **3**: 1759. 1806.

Plants laxly gregarious or mixed with other mosses; stems to 2 cm. high. Stem leaves linear-lanceolate from a slightly broader base, narrowly and irregularly bordered in the median part with elongated cells in several rows, sharply pointed, entire or minutely serrulate above; costa percurrent; upper cells irregularly hexagonal, cancellinae in 15–20 rows, acutely angled above. Comal leaves shorter and broader, often bearing on the inner face near the costa conspicuous

filiform propagula. Seta short; capsule erect, cylindrical; peristome teeth short and irregular, barely exceeding the rim. (Fig. 35, D–G.)

Dept. Peten: *Lundell 3047.* Dept. Alta Verapaz: *Standley 90775a.*

Distribution: Florida, Mexico, Panama, West Indies, Galapagos Islands.

On trees and logs at low altitudes. The irregular, narrow, yellowish border, ending far below the apex and the characteristic propagula of the terminal leaves easily separate this species from its congeners.

6. SYRRHOPODON LYCOPODIOIDES (Sw.) C. M., Syn. **1**: 538. 1849.

?Dicranum lycopodioides Sw., Prod. Fl. Ind. Occid. **3**: 1066. 1806.

Robust plants forming dense, deep tufts, yellowish at tips, brown below. Stems to 6 cm. high, branched, clothed with brown tomentum. Leaves widely spreading, to 1 cm. or more long, gradually lanceolate from a pale, erect, scarcely wider base, acuminate, keeled below, blade strongly bordered with narrow cells, border thickened, brownish, spinose-serrate with paired teeth, cancellinae cells short rectangular, gradually merging with the upper leaf cells which are rounded-quadrate, smooth and incrassate. Seta elongate; capsule oblong-cylindrical. (Fig. 31, G–H.)

Dept. Baja Verapaz: *Sharp 2760.*

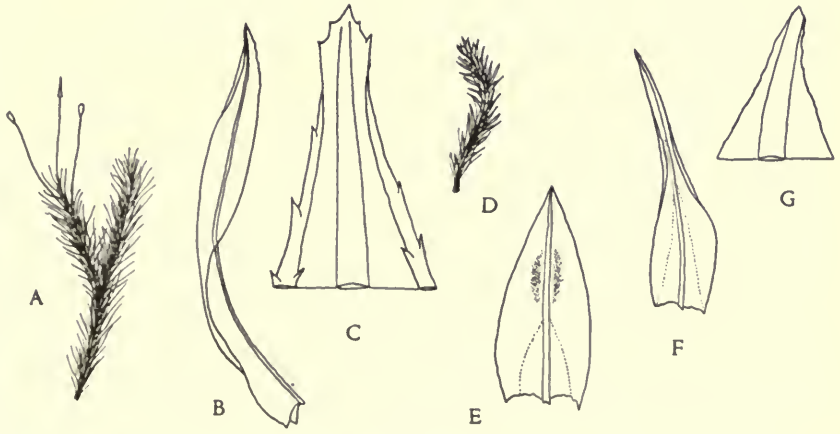

FIGURE 35

A–C, *Syrrhopodon Bernoullii:* A, plant, ×1; B, leaf, ×8; C, apex of leaf, ×134. D–G, *Syrrhopodon parasiticus:* D, plant, ×1; E, comal leaf, ×8; F, stem leaf, ×8; G, apex of comal leaf, ×134.

Distribution: Costa Rica, West Indies, northern and western South America to Bolivia.

On tree trunk at moderate altitude. A frequent species in the West Indies but uncommon in Central America where it has been collected before only in Costa Rica.

2. CALYMPERES Sw., in Schwaegr. Suppl. 1[2]: 333. 1816.

Small to moderately robust, mostly corticolous plants growing in tufts. Leaves crispate when dry, lanceolate or ligulate from a broader, whitish base; costa stout, often thickened at apex and bearing apical clusters of propagula; lamina cells small, changing abruptly to the lax, hyaline cancellinae cells of the leaf base, frequently with narrow, intramarginal bands of elongate cells (teniolae) extending through the shoulders upward into the blade; margins usually thickened and serrate. Seta short; capsule subcylindric; peristome lacking; calyptra campanulate, plicate, persistent.

1. Leaves 10 mm. or more long, upper cells transversely elongate ..... 5. *C. lonchophyllum*
   Leaves less than 5 mm. long, upper cells rounded 2
2. Upper leaf cells about 4 μ in diam. ..... 1. *C. Donnellii*
   Upper leaf cells 6–8 μ in diam. 3
3. Teniolae short, leaf border very thick ..... 4. *C. nicaraguense*
   Teniolae extending above midleaf, leaf border slightly thickened 4
4. Teniolae 2–3 cells in from margin at shoulders, leaves entire above ..... 2. *C. Richardi*
   Teniolae 4–8 cells in from margin at shoulders, leaves serrate above ..... 3. *C. emersum*

1. CALYMPERES DONNELLII Aust., Bot. Gaz. 4: 151. 1879.

Plants less than 1 cm. high, often forming green mats. Leaves incurved and crisped when dry, 2.5–5 mm. long, broadly linear from an oblong base, tubulose above; margins thickened, irregularly doubly serrate above, serrulate below; costa stout; upper cells minute, diam. 4–5 μ, papillose; teniolae distinct, 8–12 cells in from margin at shoulders, extending about half way up the blade; cancellinae in 12–14 rows, acutely angled above. Seta 5 mm. long; capsule about 2 mm. long. (Fig. 36, A–E.)

Dept. Peten: *Lundell 2072a.* Dept. Izabal: *Steyermark 41813a.*

Distribution: Florida, Honduras, Panama, West Indies, northern South America, Cocos Island.

On rocks and tree trunks at low altitudes.

2. CALYMPERES RICHARDI C. M., Syn. **1**: 524. 1849.

Stems to 1 cm. high, rarely higher. Leaves incurved and crisped when dry, small below, the upper 3–4 mm. long, oblong-ovate from a slightly wider variable base, broadly acute or obtuse; margins entire above, serrulate at shoulders; costa stout, scabrous on both sides above, ending below apex; upper cells rounded, distinct, 6–8 μ; teniolae 1–5 cells in from margins at shoulders, extending into the thickened border toward apex; cancellinae rounded above. Abnormal leaves narrower, club-shaped, bearing numerous propagula. Seta 3 mm. long; capsule narrowly oval. (Fig. 36, F–H.)

Distribution: Florida, Mexico, British Honduras, West Indies, Brazil.

On trees at low altitudes. A frequent species, widely distributed in Caribbean regions but apparently rare or overlooked in the local area.

3. CALYMPERES EMERSUM C. M., Bull. Herb. Boiss. **5**: 189. 1897.

Similar in appearance to *C. Richardi*. Leaves to 4 mm. long, oblong-linear from a narrowly obovate, serrulate base, acute;

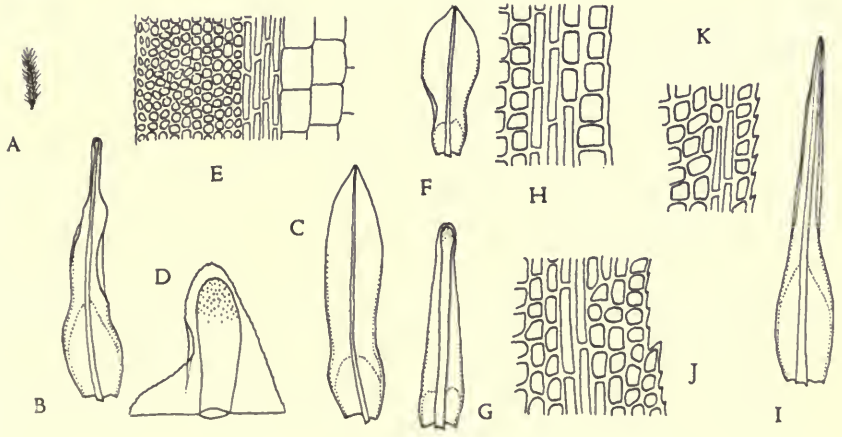

FIGURE 36

A–E, *Calymperes Donnellii:* A, plant, ×1; B, abnormal leaf, ×14; C, normal leaf, ×14; D, apex of normal leaf, ×134; E, cells and margin near leaf shoulder, ×270.

F–H, *Calymperes Richardi:* F, normal leaf, ×14; G, abnormal leaf, ×14; H, cells and margin near leaf shoulder, ×270.

I–K, *Calymperes emersum:* I, leaf, ×14; J, cells and margin near leaf shoulder, ×270; K, upper leaf cells and margin, ×270.

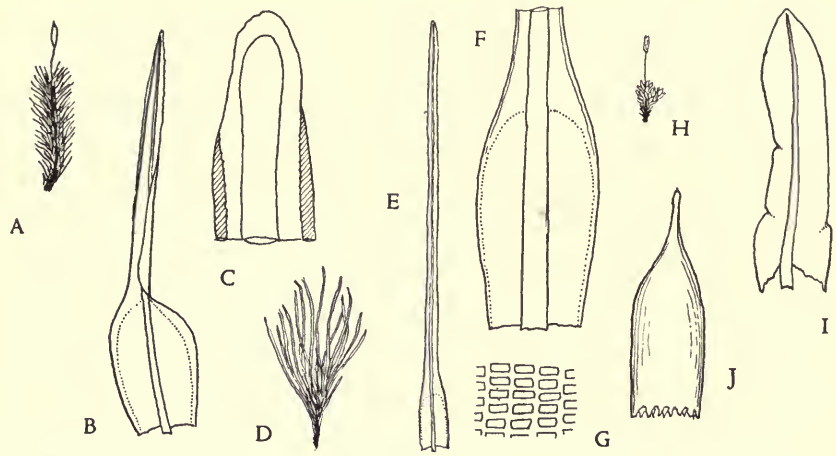

FIGURE 37

A–C, *Calymperes nicaraguense:* A, plant, ×1; B, leaf, ×12; C, apex of leaf, ×134.

D–G, *Calymperes lonchophyllum:* D, moist plant, ×1; E, leaf, ×4; F, base of leaf, ×18; G, leaf cells near shoulder, ×270.

H–J, *Encalypta vulgaris:* H, plant, ×1; I, leaf, ×14; J, calyptra, ×8.

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margins of blade serrulate; costa ending just below apex; upper cells papillose, angular, 7–8 μ; cancellinae acutely angled above; teniolae extending nearly to apex and 4–8 cells in from margins at shoulders. Sporophyte not seen. (Fig. 36, I–K.)

Distribution: Florida, Honduras, Panama.

Distinguished from *C. Richardi* by the narrower leaf blade serrulate on the margins and the longer teniolae. No Guatemalan specimens have been seen.

4. CALYMPERES NICARAGUENSE Ren. & Card., Bull. Soc. Bot. Belg. 33[2]: 117. 1894.

Calymperes Carionis C. M., Bull. Herb. Boiss. 5: 189. 1897.

Rather robust, dark green plants. Stems densely foliate, to 2.5 cm. high. Leaves crispate when dry, to 4.5 mm. long, linear from an obovate, serrulate base, bluntly pointed; margins of blade strongly thickened, serrulate; costa nearly percurrent, scabrous on both sides above; upper cells rounded or angular, mammillose on ventral face, nearly smooth on back; teniolae 8–10 cells in from margins at shoulders, soon merging with the thickened border above and disappearing below shoulders; cancellinae rounded or broadly angled

above. Seta 5–6 mm. long; capsule cylindrical, about 2.5 mm. long. (Fig. 37, A–C.)

Distribution: Nicaragua, British Honduras, Costa Rica, Panama, Guadeloupe.

I have a part of the type collection from Nicaragua but have not seen the material described as *C. Carionis* from Guatemala. Like its associates it is a lowland species.

5. CALYMPERES LONCHOPHYLLUM Schwaegr., Suppl. 1^2: 333. 1816.

Plants with short stems and very long leaves, growing in extensive yellowish green mats. Stems under 5 mm. long. Leaves crowded, 10–15 mm. or more long, flexuous or strongly curled when dry, narrowly linear from a very short, ovate, serrulate base, acute; margins of blade thickened and distantly doubly serrulate; costa nearly percurrent; cells of blade often in two layers, smooth, transversely oval, incrassate, longer diameter 8–10 μ; teniolae lacking or very indistinct; cancellinae in two layers toward costa, in 6–7 rows, rounded or truncate above. Seta 10–12 mm. long, often slightly scabrous above; capsule 2 mm. long. (Fig. 37, D–G.)

Dept. Peten: *Lundell 2051; Bartlett 12441, 12472.* Dept. Izabal: *Steyermark 38891, 39200.* Dept. Alta Verapaz: *Steyermark 44465, 44995.*

Distribution: British Honduras, Costa Rica, West Indies, northern South America.

On trees and logs at low altitudes. Readily known by the long, narrow leaves, much longer than the stems.

9. ENCALYPTACEAE

Coarse, rather robust, densely tufted plants. Leaves crisped when dry, ligulate, obtuse or apiculate; costa strong, ending below apex or excurrent; upper cells hexagonal, densely papillose, basal cells rectangular, smooth. Seta erect; capsule erect, cylindrical; peristome lacking or variable; lid beaked; calyptra large and conspicuous, campanulate, erose or fringed at base.

1. ENCALYPTA Hedw., Sp. Musc. 60. 1801.

A single genus with the characters of the family.

1. ENCALYPTA VULGARIS Hedw., Sp. Musc. 60. 1801.

Autoicous; stems 0.5 cm. or more high, tomentose below. Leaves lightly crisped when dry, 2–3 mm. long, oblong-ligulate from a

slightly broader, yellowish base, broadly acute or obtuse; margins erect or slightly recurved below, papillose-crenulate in blade; costa stout, reddish, ending below apex; upper cells hexagonal, very obscure, densely papillose, basal cells rectangular, often with thickened end walls, linear toward margins. Seta 5 mm. or more long, red; capsule furrowed and wrinkled when dry and empty; peristome lacking; calyptra straw colored, covering capsule, ragged at base, scabrous above. (Fig. 37, H–J.)

Dept. Huehuetenango: *Standley 83090b.*

Distribution: Western United States; Europe, Asia, Africa.

On soil at high altitude. This species is frequent in the mountains of Arizona and New Mexico but I know of no other record south of the border.

10. POTTIACEAE

Small to moderately robust, densely tufted plants, mostly rupestrine or terrestrial and partial to calcareous substrata. Stems erect, usually branched. Leaves often crisped when dry; costa strong; upper cells small, usually papillose, often obscure, basal cells rectangular, often hyaline. Seta erect, elongate, smooth; capsules erect, subcylindric, symmetrical, smooth; lid beaked; peristome lacking or of 16 erect or spirally twisted teeth from a basal membrane, entire or divided into 2 filiform, papillose forks; calyptra cucullate.

1. Costa with dorsal and ventral stereid bands 2
   Costa with dorsal stereid band only 19
2. Sporophyte lateral ..... 1. *Anoectangium*
   Sporophyte terminal (except Pleurochaete) 3
3. Leaf margin involute 4
   Leaf margin plane or revolute 5
4. Peristome lacking ..... 3. *Hymenostomum*
   Peristome present ..... 4. *Weisia*
5. Leaves with a thickened border ..... 21. *Morinia*
   Leaf border not thickened 6
6. Hyaline basal cells extending upward along leaf margin 7
   Hyaline basal cells not as above 8
7. Leaf margins entire, sporophyte terminal ..... 13. *Tortella*
   Leaf margins toothed, sporophyte lateral ..... 14. *Pleurochaete*
8. Peristome lacking 9
   Peristome present 12

9. Leaves broadly lingulate....17. *Hyophila*
Leaves narrower, usually lanceolate.... 10

10. Lid remaining attached to columella after dehiscence....7. *Hymenostylium*
Lid not persistent, free from columella.... 11

11. Leaves long and slenderly acuminate....9. *Turckheimia*
Leaves acute or obtuse....5. *Gymnostomum*

12. Lamina cells in 2 layers....12. *Timmiella*
Lamina cells in one layer.... 13

13. Peristome teeth spirally twisted....20. *Barbula*
Peristome teeth erect or nearly so.... 14

14. Leaf base obovate, strongly sheathing.... 15
Leaf base ovate, not sheathing the stem.... 16

15. Leaves toothed near apex, short pointed....8. *Rhamphidium*
Leaves entire, slenderly acuminate....11. *Pseudosymblepharis*

16. Leaves strongly toothed above....16. *Leptodontium*
Leaves entire or nearly so.... 17

17. Leaf margins revolute....19. *Didymodon*
Leaf margins plane.... 18

18. Leaves lingulate, apex rounded....18. *Weisiopsis*
Leaves lanceolate, sharply pointed....10. *Trichostomum*

19. Costa broad, ventral surface densely filamentose....24. *Aloinella*
Costa narrow, without filaments.... 20

20. Upper lamina cells and margins bistratose....15. *Trichostomopsis*
Leaf cells in one layer.... 21

21. Leaf cells smooth.... 22
Leaf cells papillose.... 23

22. Peristome lacking, leaves bordered with several rows of paler incrassate cells....2. *Merceya*
Peristome present, leaves unbordered or bordered with elongated cells 22. *Streptopogon*

23. Leaf apex rounded, peristome very rudimentary....6. *Husnotiella*
Leaf apex pointed, peristome well developed.... 24

24. Peristome teeth spirally twisted....25. *Tortula*
Peristome teeth not or scarcely twisted....23. *Desmatodon*

1. ANOECTANGIUM Schwaegr., Suppl. 1[1]: 33. 1811.

Slender plants in bright green tufts or cushions. Leaves lanceolate or oblong, crispate when dry; costa subpercurrent; cells small, papillose, more elongate and pellucid below. Setae lateral, elongate, slender; capsule oblong; lid obliquely rostrate; peristome none; calyptra cucullate.

1. Leaves lanceolate, gradually acuminate 2
   Leaves oblong, broadly pointed 3
2. Plants bright or yellowish green above, upper leaf cells obscure, densely papillose
   2. *A. compactum*
   Plants glaucous green above, upper leaf cells distinct, less papillose
   3. *A. incurvans*
3. Leaves apiculate ..... 1. *A. euchloron*
   Leaf apex obtusely rounded 4
4. Lamina cells often in 2 layers ..... 5. *A. obtusifolium*
   Lamina cells in one layer ..... 4. *A. arizonicum*

1. ANOECTANGIUM EUCHLORON (Schwaegr.) Mitt., Journ. Linn. Soc. **12**: 176. 1869.

Gymnostomum euchloron Schwaegr., Suppl. 2[2]: 83. 1827.

Stems about 1 cm. high, radiculose below, branched. Leaves spirally contorted and somewhat crispate when dry, to 1.25 mm. long, narrowly oblong, keeled, obtuse, mucronate; margins plane, papillose-crenulate; costa subpercurrent, scabrous on back above; upper cells about 5 μ, densely papillose, obscure, more pellucid and distinct at base and rectangular toward costa. Setae lateral, to 6 mm. long; capsule ovoid-cylindric, barely 1 mm. long. (Fig. 38, A–D.)

Dept. Huehuetenango: *Standley 82434*. Dept. San Marcos: *Standley 68696*. Dept. Quezaltenango: *Standley 84569, 84597, 85142; Steyermark 33619*. Dept. Retalhuleu: *Standley 88158*. Dept. Sacatepequez: *Standley 58637*. Dept. Chimaltenango: *Standley 57918, 61634, 62050*. Dept. Guatemala: *Standley 59689*. Dept. Zacapa: *Steyermark 42459*. Dept. Jalapa: *Steyermark 32190*. Dept. Santa Rosa: *Standley 78361*.

Distribution: Wide in tropical America, Hawaii, Malaysia, Africa.

On banks and rocks at moderate altitudes. The broadly pointed, apiculate leaves are distinctive in comparison with the other local species.

2. ANOECTANGIUM COMPACTUM Schwaegr., Suppl. **1**[1]: 36. 1811.

Anoectangium condensatum Schimp., Besch. Prodr. Bryol. Mex. 16. 1871.

Compactly tufted plants, bright or yellowish green above, brown below. Stems to 4 cm. or more long. Leaves strongly contorted when dry, 1–1.75 mm. long, linear-lanceolate, keeled, short acuminate; margins erect, papillose-crenulate; costa subpercurrent, papillose on back above; upper cells 6–8 μ, densely papillose, obscure, inner basal cells short rectangular, pellucid, incrassate. Seta about

10 mm. long; capsule ovoid-cylindric, 1–1.5 mm. long. (Fig. 38, E–G.)

Dept. Huehuetenango: *Standley 82880.* Dept. San Marcos: *Steyermark 35696, 35823, 35824; Standley 85392.* Dept. Quezaltenango: *Standley 84182, 84751, 85263; Steyermark 34765a, 34766a.* Dept. Suchitepequez: *Steyermark 46831a.* Dept. Sacatepequez: *Standley 58931.* Dept. Solola: *Steyermark 46930.* Dept. Chimaltenango: *Standley 61540.* Dept. El Progresso: *Steyermark 43058, 43339, 43660, 43661.* Dept. Jalapa: *Steyermark 32438.*

Distribution: Greenland, northern United States, Mexico, South America, Africa, Asia, New Zealand.

On banks and rocks mostly at high altitudes. The distinctions between *A. condensatum* and *A. compactum* are so tenuous that I doubt if they can be separated in practice. I agree with Thériot (**29**, p. 94) that they are conspecific.

3. ANOECTANGIUM INCURVANS (Schimp.) Bartr., Bryol. **49**: 111. 1946.

Gymnostomum incurvans Schimp. in Besch., Prodr. Bryol. Mex. 15. 1871.

Stems 2–3 cm. high, densely reddish tomentose below, dark green and often glaucous above. Leaves strongly incurved when dry,

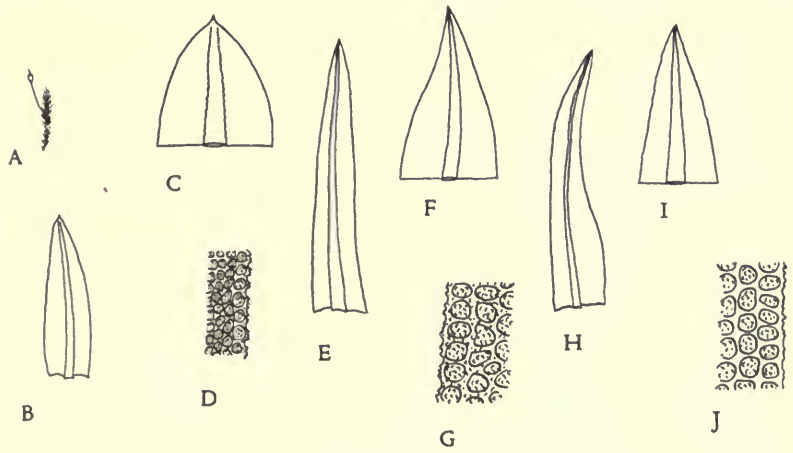

FIGURE 38

A–D, *Anoectangium euchloron:* A, plant, ×1; B, leaf, ×20; C, apex of leaf, ×134; D, upper leaf cells and margin, ×270.

E–G, *Anoectangium compactum:* E, leaf, ×20; F, apex of leaf, ×134; G, upper leaf cells and margin, ×270.

H–J, *Anoectangium incurvans:* H, leaf, ×20; I, apex of leaf, ×134; J, upper leaf cells and margin, ×270.

2–2.4 mm. long, narrowly linear-lanceolate, acuminate; margins erect, minutely papillose-crenulate; costa percurrent; upper cells distinct, rounded, incrassate, lightly papillose, diameter 8–10 μ, inner basals rectangular, smooth, pellucid. Inflorescence lateral (Thériot **27**, pt. 3, p. 8); sporophyte not seen. (Fig. 38, H–J.)

Dept. Huehuetenango: *Standley 81205* (as *Hymenostylium recurvirostrum*). Dept. Zacapa: *Steyermark 43169*.

Distribution: Mexico.

On rock and bank at moderate altitude. The leaf structure of this species is quite similar to that of *Hymenostylium recurvirostrum* but the plane leaf margins and lateral inflorescence suggest that it may be more aptly included in *Anoectangium*.

4. ANOECTANGIUM ARIZONICUM Bartr., Moss Fl. No. Amer. 1^3: 192. 1938.

Slender plants in dense cushions, bright green above, brown below. Stems to 2.5 cm. long, branched. Leaves crispate when dry, to 1 mm. long, oblong-ligulate, carinate-concave, obtusely rounded, not apiculate; margins erect, papillose-crenulate; costa ending below apex, rough on back; upper cells small, papillose, incrassate, elongate and short rectangular near costa at base. Fruit unknown. (Fig. 39, A–C.)

Dept. El Quiche: *Sharp 2494*. Dept. El Progresso: *Sharp 5099*.

Distribution: Arizona, Mexico.

Moist boulders and bark of trees at medium to rather high altitudes. A wide range extension of a species previously known only from Arizona and northern Mexico.

5. ANOECTANGIUM OBTUSIFOLIUM (Broth. & Par.) Grout, Moss Fl. of No. Amer. 1^3: 150. 1938.

Molendoa obtusifolia Broth. & Par., Rev. Bryol. **40**: 36. 1913.

Forming dense tufts or mats, glaucous green above, brown below. Stems branched, brittle, sparingly radiculose below, to 1.5 cm. high. Leaves incurved when dry, 1.5–2 mm. long, oblong-ligulate, obtuse; margins plane, papillose-crenulate; costa ending below apex; upper cells obscure, papillose, diam. 6–8 μ, often in two layers, basal cells short rectangular with firm, pale, pellucid walls. (Fig. 39, D–F.)

Dept. Baja Verapaz: *Sharp 2805*.

Distribution: Arizona, Mexico.

On tree at moderately low altitude. As these plants lack fruit the determination remains questionable but the bluntly rounded, plane margined leaves with the lamina cells here and there in two layers suggest this species.

2. MERCEYA Schimp., Syn. Ed. 2. 852. 1876.

Rather robust plants with branched stems. Leaves ligulate, obtuse, bordered with 3–8 rows of incrassate, often colored cells; upper leaf cells irregularly rounded, smooth, basal cells rectangular; costa ending below apex, in cross section showing a stereid core with 1 or 2 layers of large, thin walled cells on the ventral surface. Seta terminal, slender; capsule erect, ovoid-cylindric; lid conic-rostrate, peristome none.

1. MERCEYA LIGULATA (Spruce) Schimp., Syn. Ed. 2. 852. 1876.

Encalypta? ligulata Spruce, Musc. Pyren. No. 331. 1845; Trans. Bot. Soc. 3[3]: 187. 1850.

Weisia agoyanensis Mitt., Journ. Linn. Soc. **12**: 135. 1869.

Weisia cataracta Mitt., Journ. Linn. Soc. **12**: 135. 1869.

Merceyopsis mexicana Bartr., Journ. Wash. Acad. Sci. **18**, no. 21: 577. 1928.

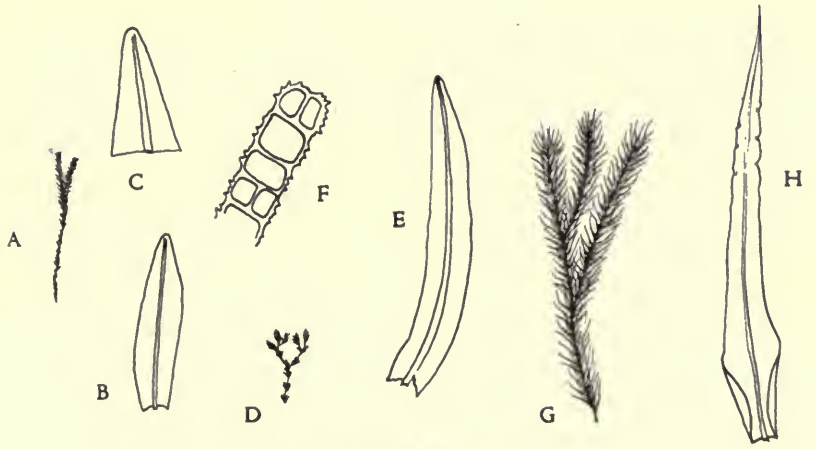

FIGURE 39

A–C, *Anoectangium arizonicum:* A, plant, ×1; B, leaf, ×30; C, apex of leaf, ×110.

D–F, *Anoectangium obtusifolium:* D, plant, ×1; E, leaf, ×28; F, part of cross section of leaf, ×270.

G–H, *Tortella tortuosa:* G, plant, ×1; H, leaf, ×10.

Stems 1–5 cm. high, densely tufted. Leaves crowded, contorted when dry, 1.5–5 mm. long, ligulate or oblong-spatulate, rounded, obtuse or acute, often bordered with 3–8 rows of thick walled, colored cells; costa ending below apex or nearly percurrent; upper cells quadrate or slightly elongate, with firm walls, 10–15 μ, more incrassate and thicker toward margins, basal cells oblong, thin walled; margins entire, slightly recurved below. Seta yellowish, erect, 2–5 mm. long; capsule ovoid-cylindric, lightly furrowed when dry and empty, urn 1–1.5 mm. long; peristome lacking; lid erect, short conic-rostrate. (Fig. 40, A–E.)

Dept. Quezaltenango: *Standley 67426, 67428, 83336, 83385, 83389, 86049, 86053; Steyermark 34663, 34665, 34657, 34977.* Dept. Chiquimula: *Steyermark 30977.*

Distribution: Tennessee, Arizona, Mexico, Costa Rica, Ecuador, Europe.

On wet banks and rocks at high altitudes. As far as I can see there is but one species in North America extending south to Ecuador. The leaves vary considerably in outline from spatulate and broadly rounded to oblong and acute. The leaf border of incrassate cells is variable, often very prominent and again hardly noticable.

3. HYMENOSTOMUM R. Brown, Trans. Linn. Soc. **12**[2]: 573. 1819.

Small plants with crisped leaves; partial to calcareous habitats. Differing from *Weisia* only in the lack of a peristome; the mouth of capsule covered with a fugacious membrane developed from the top of the columella.

1. HYMENOSTOMUM JAMESONI (W. Arn.) Broth., E. & P. Nat. Pflanzenf. **1**[3]: 386. 1902.

Gymnostomum Jamesoni W. Arn., in Wern. Transact. 5: 200(?).

Small, laxly gregarious plants. Stems 2–3 mm. high. Leaves strongly contorted when dry, erect-spreading when moist, to 2 mm. long, linear-lanceolate from a pale, ovate base, acute, mucronate, entire; margins narrowly involute above base; costa pale, 50–60 μ wide below, excurrent in a sharp, pale mucro; upper cells small, opaque, obscure, papillose, basal cells rectangular, pellucid, smooth. Seta 4–5 mm. long, pale yellow; capsule erect, ovoid, urn 1–1.1 mm. long; peristome lacking; lid conic-rostrate, 0.5 mm. long. (Fig. 40, F–H.)

Dept. Quezaltenango: *Sharp 1947.* Dept. Zacapa: *Steyermark 42746.*

Distribution: Brazil.

On soil at moderate to high altitudes. A critical study of the tropical American species of this genus is essential before they can be named with any certainty. As far as I can see there are no important differences between Sharp's 1947 and plants from Brazil, determined as *H. Jamesoni.* Steyermark's 42746 is sterile and therefore questionable, but it may be remarked that the leaves here match very closely the type material of *H. mexicanum* Card. and also those of *H. tortile* Bry. Eur.

4. WEISIA Hedw., Sp. Musc. 64. 1801.

Stems short, branched. Lower leaves small, upper much longer, crisped when dry, narrowly lanceolate from a broader base; upper margins involute; costa short excurrent; basal cells hyaline, upper cells small, opaque, papillose. Seta elongate; capsule erect; peristome teeth variable, entire or divided.

Costa rarely over 50μ wide below.....1. *W. viridula*
Costa 70–75 μ wide below.....2. *W. jamaicensis*

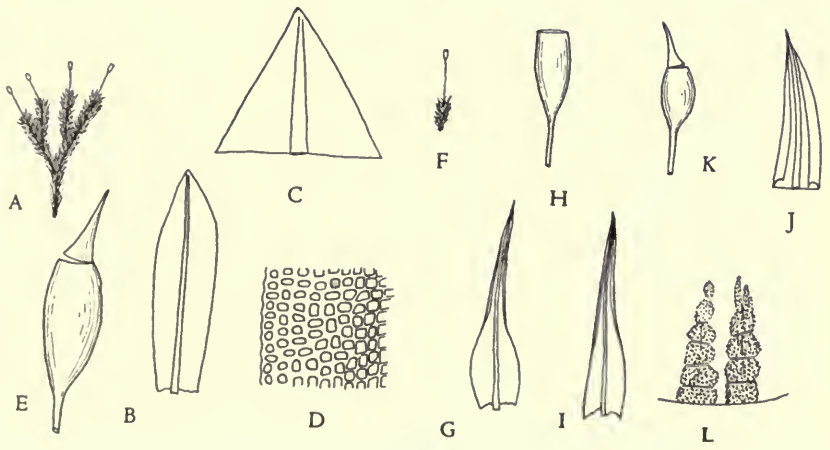

FIGURE 40

A–E, *Merceya ligulata:* A, plant, ×1; B, leaf, ×16; C, apex of leaf, ×134; D, upper leaf cells and margin, ×270; E, capsule, ×14.

F–H, *Hymenostomum Jamesoni:* F, plant, ×1; G, leaf, ×14; H, capsule, ×8.

I–L, *Weisia viridula:* I, leaf, ×14; J, apex of leaf, ×134; K, capsule, ×8; L, part of peristome, ×134.

1. WEISIA VIRIDULA Hedw., Sp. Musc. 68. 1801.

Plants bright green or yellowish green in low tufts. Stems to 5 mm. or more high. Upper leaves lanceolate, sharply pointed, 2.5–3 mm. long; margins strongly involute and entire above; costa narrow, excurrent, 35–45 μ wide at base; upper cells 6–7 μ, densely papillose, opaque, basal cells rectangular, hyaline, smooth. Seta 3–7 mm. high; capsule oblong-cylindric; peristome teeth variable, short and truncate or lanceolate. (Fig. 40, I–L.)

Dept. Jutiapa: *Standley 75228a.*

Distribution: Cosmopolitan but apparently infrequent in Central America.

On soil at moderate altitude.

2. WEISIA JAMAICENSIS (Mitt.) Grout, Moss Fl. of No. Amer. **1**: 157. 1938.

Tortula jamaicensis Mitt., Journ. Linn. Soc. **12**: 147. 1869.

Trichostomum Purpusi Card., Rev. Bryol. **36**: 73. 1909.

Trichostomum involvens Card., Rev. Bryol. **40**: 34. 1913.

Stems to 1 cm. or more high. Leaves 3–4 mm. long, linear from a broader oblong-ovate, hyaline base, sharply pointed; margins strongly involute; costa strong, 75–80 μ wide below, excurrent; basal cells rectangular, upper cells small, dense, opaque, papillose. Seta 8–15 mm. long; capsule cylindric, urn 2–2.5 mm. long; peristome teeth divided nearly to base into 32 filiform, papillose forks. (Fig. 41, A–D.)

Dept. Alta Verapaz: *Standley 89664.* Dept. Sacatepequez: *Standley 58985a.*

Distribution: Southern United States, Mexico, West Indies.

On banks and rocks at moderate altitude. In no. 89664 the leaves are typically narrow and sharply pointed while in no. 58985a they are broader and bluntly pointed, but I believe both collections may safely be referred here.

5. GYMNOSTOMUM Hedw., Sp. Musc. 30. 1801.

Dioicous; small, slender plants usually occurring in limestone regions. Leaves narrowly lanceolate, contorted when dry; basal cells rectangular, hyaline, upper cells small, papillose, obscure. Seta elongate; capsule erect, ovoid; peristome lacking; lid not persistent.

Stems short, leaves lingulate, often obtuse.....2. *G. calcareum*
Stems elongate, leaves lanceolate, acute.....1. *G. aeruginosum*

1. GYMNOSTOMUM AERUGINOSUM Sm., Fl. Brit. **3**: 1163. 1804.

Gymnostomum rupestre Schleich., Cat. 29. 1807.

Slender plants in compact cushions, green above, pale brown below, incrusted with a calcareous deposit. Stems about 3 cm. high. Leaves to 1.6 mm. long, narrowly linear-lanceolate, broadly acute; margins plane; costa stout, about 60 μ wide below, ending below apex; upper cells 10–12 μ, obscure, densely papillose, rectangular and hyaline at base. Seta short; capsules short oblong. (Fig. 41, E–G.)

Dept. Huehuetenango: *Standley 82781* (sterile).

Distribution: Southern Canada to Texas and Arizona, Europe, Asia, China, Japan.

On damp, calcareous bank at moderate altitude. Not recorded before from below the United States border.

2. GYMNOSTOMUM CALCAREUM Nees & Hornsch., Bry. Germ. **1**: 53. 1823.

Stems short, 4–8 mm. high. Leaves less than 1 mm. long, similar to those of *G. aeruginosum* but often obtusely rounded at apex.

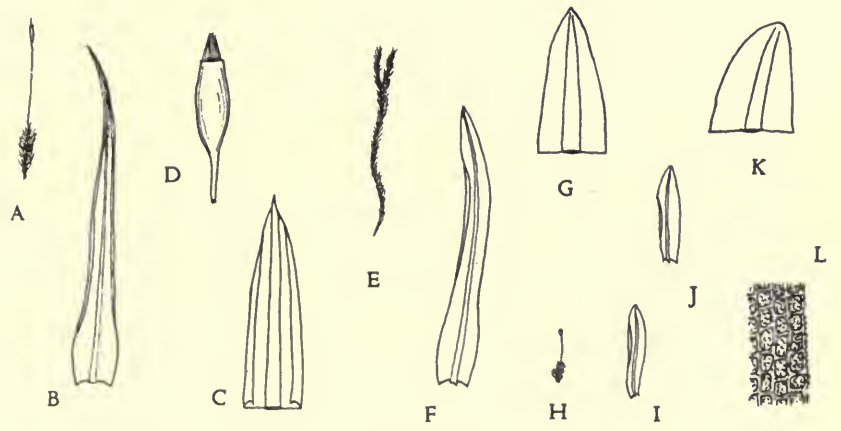

FIGURE 41

A–D, *Weisia jamaicensis:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×134; D, capsule, ×8.

E–G, *Gymnostomum aeruginosum:* E, plant, ×1; F, leaf, ×26; G, apex of leaf, ×134.

H–L, *Gymnostomum calcareum:* H, plant, ×1; I and J, leaves, ×26; K, apex of leaf, ×134; L, upper leaf cells and margin, ×270.

Seta 4–5 mm. long; capsule short ovoid, urn about 0.7 mm. long. (Fig. 41, H–L.)

Dept. Huehuetenango: *Standley 65641, 65661, 65804.* Dept. Sacatepequez: *Standley 58936.* Dept. Guatemala: *Standley 62866.*

Distribution: Newfoundland to California south to West Virginia and Arizona, Europe, Asia, Africa.

On damp banks and cliffs at moderate to rather high altitudes. These collections are typical and several of them well fruited.

6. HUSNOTIELLA Card., Rev. Bryol. **36:** 71. 1909.

Plants small, closely tufted. Stems short, erect. Leaves ovate-lingulate, rounded at apex; margins entire, revolute; costa ending below apex, with stereids on dorsal side only; cells small, papillose, obscure, rectangular and smooth below. Seta elongate; capsules erect; peristome very rudimentary or none.

1. HUSNOTIELLA REVOLUTA Card., Rev. Bryol. **36:** 71. 1909.

Stems to 1 cm. high, olive green above, brown below. Leaves strongly contorted when dry, about 1 mm. long, lingulate, rounded at apex; margins revolute except near base; costa strong, ending below apex, wider and spurred above; cells rounded, mammillose, 8–10 μ, basal cells short rectangular, hyaline. Seta 6–8 mm. long; capsules erect, subcylindric. (Fig. 42, A–C.)

Dept. Jalapa: *Steyermark 32156.*

Distribution: Southwestern United States, Mexico.

On shaded bricks of path at moderate altitude. The short, lingulate, rounded leaves with revolute margins and thick, spurred costa are distinctive characters.

7. HYMENOSTYLIUM Brid., Bryol. Univ. **2:** 81. 1827.

Dioicous; slender, compactly tufted plants, green above, brown below. Stems long, fragile, tomentose. Leaves curved when dry, narrowly lanceolate, acuminate; margin recurved below; costa ending below apex; cells rounded, papillose, rectangular below. Seta elongate; capsules ovoid, wide mouthed; peristome lacking; lid remaining attached to columella after dehiscence.

1. HYMENOSTYLIUM RECURVIROSTRUM (Hedw.) Dix., Rev. Bryol. et Lich. **6**: 96. 1933.

Gymnostomum recurvirostrum Hedw., Sp. Musc. 33. 1801.

Stems to 3–4 cm. long or longer. Leaves crowded, to 2 mm. or more long, keeled; margins recurved on one or both sides below; upper cells distinct, rounded or angular, diam. 8–10 μ, papillose, incrassate, rectangular basal cells few. Seta 8–10 mm. long; capsule erect and slenderly beaked, lid persistent. (Fig. 42, D–F.)

Dept. Alta Verapaz: *Steyermark 44575; Standley 70882a.* Dept. Huehuetenango: *Standley 81621, 81672a, 81688; Steyermark 50000a, 50146a, 50152, 50282a, 51235.* Dept. San Marcos: *Steyermark 35701, 36888a.* Dept. Zacapa: *Steyermark 42934.*

Distribution: Labrador to Alaska south to South Carolina, California and West Indies, wide in Europe, Asia, New Zealand.

On calcareous rocks and bluffs at medium to high altitudes. These collections are all sterile and although variable have in common narrowly lanceolate leaves with at least one margin recurved below and distinct upper cells. Some of the forms with longer, crispate leaves are quite similar to *Amphidium Mougeotii* (Bry. Eur.) but it seems more conservative to include them here until the problem can be clarified by fertile collections.

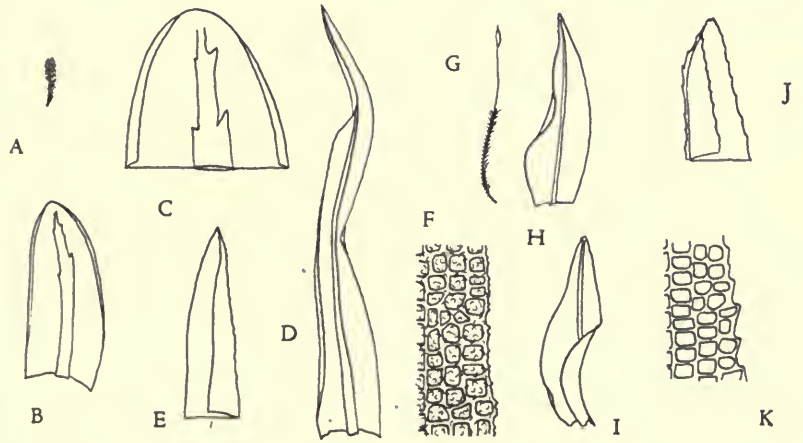

FIGURE 42

A–C, *Husnotiella revoluta:* A, plant, ×1; B, leaf, ×26; C, apex of leaf, ×120.
D–F, *Hymenostylium recurvirostrum:* D, leaf, ×26; E, apex of leaf, ×120; F, upper leaf cells and margin, ×270.
G–K, *Rhamphidium dicranoides:* G, plant, ×1; H and I, leaves, ×26; J, apex of leaf, ×120; K, leaf cells and margin near apex, ×270.

8. RHAMPHIDIUM Mitt., Journ. Linn. Soc. **12**: 45. 1869.

Small, slender plants. Leaves lanceolate from a sheathing base; margins erect; costa ending below apex; basal cells linear, upper cells subquadrate, smooth. Seta elongate; capsule nodding, oblong-cylindric; peristome teeth divided nearly to base into 2 filiform, papillose forks; lid long beaked.

1. RHAMPHIDIUM DICRANOIDES (C. M.) Bartr., Bryol. **49**: 112. 1946.

Leptotrichum dicranoides C. M., Syn. **2**: 612. 1851.

?*Trichostomum hyophilaceum* C. M., Bull. Herb. Boiss. **5**: 191. 1897.

Small, slender, yellowish plants. Stems erect, to 10 or 12 mm. high, reddish. Leaves crispate when dry, spreading when moist, scarcely 1 mm. long, lanceolate from a short, broad, clasping base, concave, obtuse; margins erect, distantly denticulate above middle; costa ending below apex, toothed on back above; upper cells subquadrate to slightly elongate, smooth, distinct, diam. about 10 μ, basal cells narrowly rectangular. Seta slender, reddish, 1 cm. long; capsule suberect to nodding, urn 1.5–1.8 mm. long. (Fig. 42, G–K.)

Dept. Retalhuleu: *Standley 87201, 87206.* Dept. Suchiate: *Svihla 2837, 2845, 2856.*

Distribution: Alabama, Louisiana, Mexico, Central America, West Indies, South America.

On wet banks at moderate altitudes. These collections differ in no way from Liebman's original gathering from Mexico. There is nothing very distinctive in the description of *Trichostomum hyophilaceum* C. M. and none of the type material is available. In all probability it will prove to be a synonym of *R. dicranoides.*

9. TURCKHEIMIA Broth., Ofv. F. Vet.-Soc. Forh. **52**, no. 7: 2. 1909–1910.

Dioicous; very small, pale green plants. Leaves linear-lanceolate, subulate-acuminate, entire; costa percurrent; upper cells small, rounded, basal cells oblong, hyaline. Seta elongate; capsule erect, cylindric; peristome in our species none or rudimentary.

1. TURCKHEIMIA GUATEMALENSIS Broth., Ofv. F. Vet.-Soc. Forh. **52**, no. 7: 2. 1909–1910.

Stems 1–2 mm. high, branched. Leaves few, flexuous-spreading when dry, about 2 mm. long, linear-lanceolate; costa ending in the

subula; upper cells rounded-hexagonal, 8 μ, obscurely mammillose, occasionally in 2 layers at margins above, basal cells lax, oblong, hyaline. Seta 5–8 mm. long, slender; capsule cylindric, urn 0.5–1 mm. long, tapering to seta. Lid and peristome not seen. (Fig. 43, A–D.)

West Guatemala: Livingston, *H. J. Turckheim 1908.*

Endemic.

This species is described as having no peristome but Mrs. Britton's notes accompanying part of the type collection in the New York Botanical Garden Herbarium indicate that traces of a peristome remain. It is evidently rare and has never been collected again to my knowledge.

10. TRICHOSTOMUM Hedw. emend. Bruch, Flora **2**: 393. 1829.

Dioicous; small to medium sized, tufted plants. Leaves narrow, crisped when dry; margins plane; costa percurrent or excurrent, with dorsal and ventral stereid bands; upper cells small, papillose, basal cells rectangular, pellucid. Seta elongate, erect; capsule cylindric; peristome teeth 16, erect, papillose, bifid or rudimentary; lid conic-rostrate.

1. Leaves linear-lanceolate, acute.....1. *T. cylindricum*
   Leaves wider, apex obtuse, mucronate..... 2
2. Stems 1–2 mm. high, leaves less than 1.5 mm. long.....3. *T. pygmaeum*
   Stems 5–10 mm. high, leaves 3–4 mm. long.....2. *T. brachydontium*

1. TRICHOSTOMUM CYLINDRICUM (Bruch) C. M., Syn. **1**: 586. 1849.

Weisia cylindrica Bruch, in Brid. Bryol. Univ. **1**: 806. 1826.

Plants loosely tufted, yellowish above, brown below. Stems to 2.5 cm. high. Leaves crispate when dry, brittle, linear-lanceolate from an erect, pale base, 3–4 mm. long, acute; margins plane, often sinuate or notched above; costa excurrent in a short, pellucid apiculus; upper cells rounded, papillose, obscure, basal cells rectangular. Seta 1–1.5 cm. long, slender, yellowish; capsules cylindric, erect or slightly curved; peristome teeth short, erect, irregular. (Fig. 43, E–G.)

Dept. Alta Verapaz: *Standley 69650a.* Dept. San Marcos: *Standley 66063; Steyermark 36115a, 36120.* Dept. Sacatepequez: *Standley 58832.* Dept. Chimaltenango: *Standley 58740a, 60962a.* Dept. Guatemala: *Standley 58485a, 80601.*

Distribution: Greenland to Manitoba south to North Carolina and Arizona, South America, Europe, Asia, Africa, Japan.

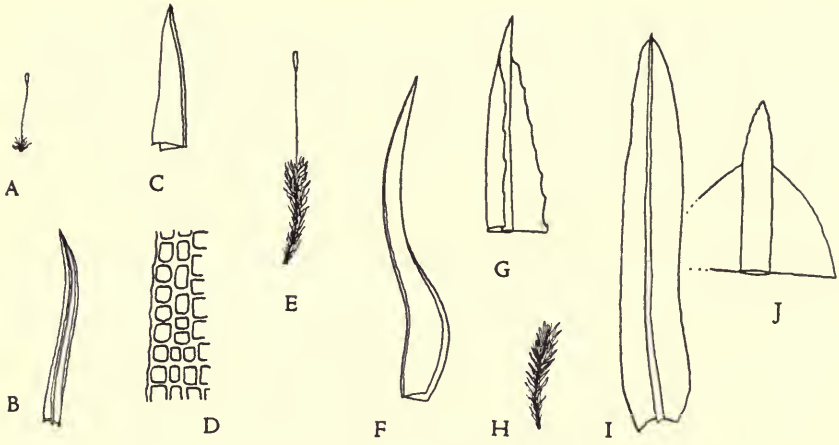

FIGURE 43

A–D, *Turckheimia guatemalensis:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, upper leaf cells and margin, ×270.

E–G, *Trichostomum cylindricum:* E, plant, ×1; F, leaf, ×14; G, apex of leaf, ×120.

H–J, *Trichostomum brachydontium:* H, plant, ×1; I, leaf, ×14; J, apex of leaf, ×120.

On banks, rocks and logs at medium to high altitudes. These collections vary considerably but no more so than in the north where the species is proverbially plastic. Some of the collections show the pellucid basal cells extending up the margins as in *Tortella* but this anomalous feature is neither constant nor well marked.

2. TRICHOSTOMUM BRACHYDONTIUM Bruch, in Flora P. **2**: 393. 1829.

Rather coarse plants in lax, brownish green tufts. Stems 1–2 cm. high. Leaves crowded, contorted and incurved when dry, 3–4 mm. long, narrowly oblong-lanceolate, short pointed, mucronate by the short excurrent costa, not fragile; upper cells small, dense, very opaque, basal cells rectangular, pellucid. Seta 1–1.2 cm. long; capsule ovoid-cylindric; peristome short or rudimentary. (Fig. 43, H–J.)

Dept. Huehuetenango: *Standley 81181; Steyermark 50282.* Dept. Zacapa: *Steyermark 42205.* Dept. Jalapa: *Standley 76448, 77310.*

Distribution: Mexico, Jamaica, Europe, Asia, Africa, Japan.

On damp banks and rocks at moderate altitudes. These collections are without fruit but the vegetative characters are in every way similar to *T. brachydontium.*

3. TRICHOSTOMUM PYGMAEUM Bartr., Bryol. **49**: 112. 1946.

Small, dull green, densely tufted plants. Stems very short, 1–2 mm. high. Lower leaves minute, the upper to 1.4 mm. long, crisped when dry; oblong-lanceolate, concave, obtuse, mucronate; margins erect, papillose-crenulate; costa ending in or just below apex, papillose on back above; upper cells densely papillose, obscure, diam. 6–8 μ, basal cells rectangular, smooth, pellucid. (Fig. 44, A–C.)

Dept. Alta Verapaz: along Rio Icvolay, north and northwest of Finca Cubilguitz to Quebrada Diabalo, alt. 300–350 m., *Steyermark 44770*, TYPE.

Endemic.

While lacking any marked characters, this species seems to be clearly different from any of its local associates in the short stems and small, bluntly pointed, concave leaves.

11. PSEUDOSYMBLEPHARIS Broth., E. & P. Pflanzenf. Ed. 2, **10**: 261. 1924.

Plants fairly robust, growing in deep tufts. Stems branched. Leaves strongly curled when dry, lanceolate from an obovate, sheathing base, acuminate; margins erect; costa excurrent; basal cells linear, hyaline, upper cells small, papillose. Seta elongate; capsule cylindric; peristome teeth erect, irregularly cleft.

1. PSEUDOSYMBLEPHARIS CIRCINATA (Schimp.) Broth., E. & P. Pflanzenf. Ed. 2, **10**: 261. 1924.

Syrrhopodon circinatus Schimp., in Besch., Prodr. Bryol. Mex. 28. 1871.

Stems to 3 cm. or more high, yellowish green, brown below. Leaves crowded, the long points widely spreading and circinate when dry, rather brittle, to 10–12 mm. long, narrowly linear-lanceolate from an erect, obovate, strongly clasping base, gradually subulate acuminate; upper margins minutely papillose-crenulate; costa excurrent in a smooth, sharp point; upper cells subquadrate, densely papillose, obscure, basal cells linear, hyaline, becoming incrassate toward shoulders with sinuose lateral walls, long and narrow toward margins and often forming an indistinct border to above leaf shoulders. Fruit unknown. (Fig. 44, D–G.)

Dept. Alta Verapaz: *Standley 71601*. Dept. Huehuetenango: *Steyermark 48575* (as *P. subulata* sp. nov.), *48928a*, *50146b*. Dept. Chimaltenango: *Standley 58781c*. Dept. Chiquimula: *Steyermark 31693*.

Distribution: Mexico, Costa Rica.

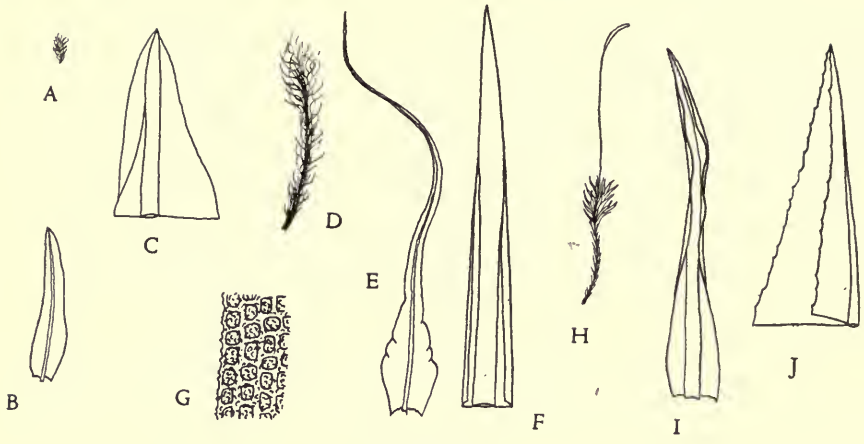

FIGURE 44

A–C, *Trichostomum pygmaeum:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120.

D–G, *Pseudosymblepharis circinata:* D, plant, ×1; E, leaf, ×6; F, apex of leaf, ×120; G, upper leaf cells and margin, ×270.

H–J, *Timmiella anomala:* H, plant, ×1; I, leaf, ×12; J, apex of leaf, ×120.

On trees and rocks at moderate altitudes. Distinguished from *Trichostomum* principally by the obovate, clasping leaf base. The narrow marginal cells of the leaf base and the slender, subulate leaf point have a suggestive parallel in *Trichostomum angustatum* (Mitt.) Fleisch. of Malaysia.

12. TIMMIELLA (DeNot.) Limpr., Laubm. **1**: 590. 1888.
Timmiella Sec. of *Trichostomum* DeNot., Cron. Briol. Ital. **1**: 14. 1886.

Plants fairly robust, laxly tufted. Leaves strongly contorted with incurved margins when dry, oblong-lanceolate, toothed above; costa strong; upper cells rounded, in 2 layers except near margins, mammillose on ventral face, basal cells rectangular, hyaline. Seta elongate; capsule cylindric; peristome teeth from a low basal membrane, divided into 32 filiform, papillose forks, erect or slightly twisted; lid conic-rostrate.

1. TIMMIELLA ANOMALA (Bry. Eur.) Limp., Laubm. **1**: 592. 1888.
Barbula anomala Bry. Eur. fasc. **13–15**. 1842.

Autoicous or synoicous; stems 1 cm. or more high. Upper leaves broadly linear from an ovate base, 4–5 mm. long, concave,

acute; margins erect or inflexed, serrate toward apex; costa broad below, ending near apex; basal cells hyaline, upper cells 7–10 μ, the dorsal layer smooth. Seta 15–20 mm. long, slender; capsules narrowly cylindric, curved, urn 4 mm. long; lid 1.5 mm. long; peristome teeth about 1 mm. long, slightly twisted. (Fig. 44, H–J.)

Dept. Sacatepequez: *Standley 65266*.

Distribution: California, Arizona, Mexico, Europe, Asia.

On damp bank at high altitude. The narrowly pointed leaves suggest that this may be the form described as *T. subanomala* Besch. from Mexico, but I doubt that it is specifically distinct.

13. TORTELLA (C. M.) Limp., Laubm. **1**: 599. 1890.
Barbula Sec. *Tortella* C. M., Syn. **1**: 599. 1849.

Medium sized plants growing in mats. Stems erect, radiculose. Leaves usually strongly crisped when dry, widely spreading when moist, linear-lanceolate; margins erect or inflexed; costa strong, excurrent, glossy on back when dry; upper cells small, rounded, papillose, basal cells rectangular, hyaline, extending up margins in a more or less distinct border. Seta elongate; capsules erect or nearly so; peristome teeth split to base into 32 filiform, papillose forks, spirally twisted; lid beaked.

1. Hyaline border of broad, rectangular cells extending more than half way up leaf ..... 1. *T. Richardsii*
Hyaline border of narrow cells confined to basal part of leaf 2

2. Leaf apex abruptly rounded and mucronate ..... 2. *T. guatemalensis*
Leaf apex slenderly subulate-acuminate 3

3. Robust plants, stems to 4 cm. or more high ..... 3. *T. tortuosa*
Small plants, stems under 1 cm. high ..... 4. *T. mollissima*

1. TORTELLA RICHARDSII Bartr., Bryol. **49**: 112. 1946.

Dull, olive green plants in dense mats. Stems to 2 cm. high, simple or branched, densely foliate, slightly radiculose below. Leaves flexuous-spreading moist and dry, slightly contorted, 4–7 mm. long, rather quickly linear-lanceolate from an ovate base, sharply acute at apex, channelled, bordered to above middle with 3–4 rows of rectangular, hyaline cells; margins erect, minutely papillose-crenulate above; costa brown, stout, short excurrent in a pellucid apiculus; upper cells rounded, obscure, diameter about 6 μ, basal cells rectangular, smooth, pellucid. Fruit unknown. (Fig. 45, A–D.)

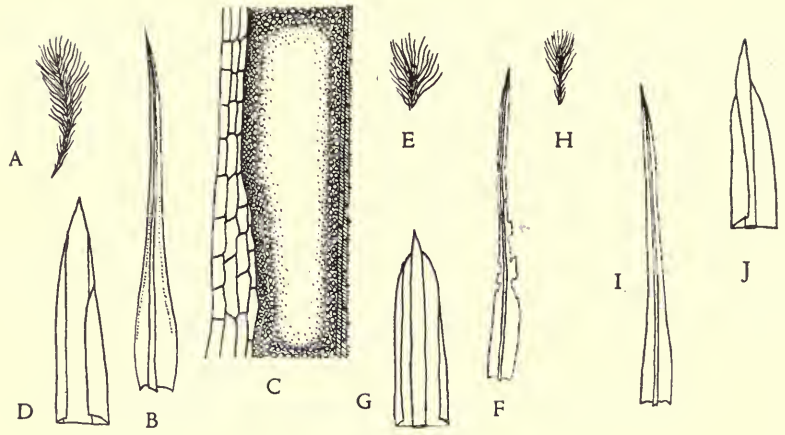

FIGURE 45

A–D, *Tortella Richardsii:* A, moist plant, ×1; B, leaf, ×8; C, one side of leaf about half way up, ×120; D, apex of leaf, ×120.

E–G, *Tortella guatemalensis:* E, moist plant, ×1; F, leaf, ×8; G, apex of leaf, ×120.

H–J, *Tortella mollissima:* H, moist plant, ×1; I, leaf, ×8; J, apex of leaf, ×120.

Dept. Alta Verapaz: Vicinity of Cubilguitz, 1½–2 miles south of Cubilguitz, alt. 300–350 m., *Steyermark 44389*, TYPE.

Distribution: British Honduras.

A very distinct and handsome species which may well prove to be generically distinct when the fruit is known. The rectangular, hyaline border cells average about 15 μ wide and up to 60 μ long and merge gradually with the basal areolation instead of continuing in a distinct marginal band below as in *Pleurochaete.*

I take pleasure in naming this unique plant for Mr. Donald Richards whose labors in packeting and labeling the extensive Guatemalan collections have greatly facilitated the study of the material.

2. TORTELLA GUATEMALENSIS Bartr., Bryol. **49**: 113. 1946.

Plants with the habit of *T. tortuosa* (Turn.) Limp. Stems scarcely 5 mm. high, laxly tufted, pale green. Leaves crowded, strongly contorted with circinate points when dry, laxly spreading when moist, to 5.5 mm. long, linear-lanceolate from a scarcely wider base, abruptly rounded and mucronate at apex, channelled above, lamina fragile and often broken; margins plane, lightly undulate

above, minutely papillose-crenulate; costa very strong below, about 90 μ wide, excurrent in a sharp, pellucid mucro; upper leaf cells densely papillose, obscure, diam. 8–10 μ, basal cells laxly rectangular, about 15 μ wide, extending up margins but much less conspicuously than in *T. tortuosa*. Sporophyte unknown. (Fig. 45, E–G.)

Dept. Alta Verapaz: *Standley 89874* (as *Trichostomum angustinerve* Card.). Dept. Huehuetenango: *Standley 82556a* (as *T. tortuosa*). Dept. Retalhuleu: *Standley 88397* TYPE (as *T. tortuosa*). Dept. Chimaltenango: *Standley*. Dept. Guatemala: *Standley 80361* (as *T. tortuosa*).

Endemic.

On trees and damp banks at moderate altitudes. I thought at first that these plants could be included in *T. tortuosa* but a more careful comparison shows that this is not practicable. The differences are not marked but consistent. In the Guatemalan plants the leaves are abruptly rounded at the apex, the basal cells are wider and more lax and less conspicuously extended up the margins.

3. TORTELLA TORTUOSA (Hedw.) Limp., Laubm. **1**: 604. 1890.

Tortula tortuosa Hedw., Sp. Musc. 124. 1801.

Robust brownish plants in dense tufts, yellow at tips, dark brown below. Stems to 4 cm. high, branched. Leaves widely spreading, strongly contorted when dry, to 6 mm. long, gradually linear-lanceolate from a short, ovate base, entire, subulate-acuminate, points fragile and usually broken off; margins erect, undulate; costa strong, excurrent; basal cells linear, porose, pellucid, extending well up margins to above leaf-shoulders; lamina cells small, obscure, densely papillose. Seta reddish, to 3 cm. long; capsule cylindrical; peristome teeth red, twisted in several turns. (Fig. 39, G–H.)

Dept. El Quiche: *Sharp 5342*. Dept. Huehuetenango: *Sharp 4811*.

Distribution: Northern United States and Canada south to the Gulf of Mexico.

On calcareous bluffs and boulders at moderately high altitudes. Although sterile, these collections are thoroughly typical of the species which has not been recorded before in North America south of the Mexican border.

4. TORTELLA MOLLISSIMA Broth., Bryol. **50**: 203. 1947.

Plants densely tufted forming extensive, low mats, yellowish or brownish green. Stems rarely over 1 cm. high. Leaves crowded,

strongly curled toward tips when dry, 4–8 or 9 mm. long, narrowly linear from a short, pale, shining, oblong-ovate base, tapering gradually to slender, subulate-acuminate tips; margins erect, not undulate; costa short-excurrent; upper cells minute, obscure, densely papillose, basal cells rectangular, hyaline, thin-walled, extending upward along margins higher than toward costa but not forming a conspicuous border. Seta 13 mm. long, reddish, slender; capsule erect, cylindrical, urn 2 mm. long; peristome not seen. (Fig. 45, H–J.)

Dept. Peten: *Lundell 2863*. Dept. Alta Verapaz: *Sharp 2940, 3002*. Dept. Baja Verapaz: *Sharp 2696*. Dept. Jalapa: *Steyermark 32553*.

Distribution: Mexico, Porto Rico, Jamaica, Trinidad.

On boulders at relatively low altitudes. This seems to be a typical Caribbean type extending into the lowlands of Mexico and Guatemala in conformity with the usual distributional picture. The only fertile plant I have seen came from Sharp's 3002, north of Coban, Alta Verapaz, alt. 4,400 ft. The capsule is too old to show the peristome structure but the sporophyte appears to be relatively smaller and more slender than in *T. tortuosa*. In *T. mollissima* the shorter stems, very narrow blades rarely over 0.22 mm. wide and not undulate on the edges, coupled with the less conspicuous border of narrow cells extending only a short way up the basal leaf margins, seem to be good diagnostic features as compared with *T. tortuosa*.

14. PLEUROCHAETE Lindb., de Tort. 253. 1864.

Plants laxly erect, in loose tufts. Stems flexuous, branched, not radiculose. Leaves lanceolate from an erect, sheathing base, bordered in lower half; margins toothed above base; costa percurrent; upper cells subquadrate, papillose, median basal cells chlorophyllose, marginal rows rectangular, pellucid, extending up margins in a narrow border. Seta lateral; peristome long, slightly twisted.

1. PLEUROCHAETE LUTEOLA (Besch.) Thér., Smiths. Misc. Coll. **78**[2]: 14. 1926.

Trichostomum luteolum Besch., Prod. Bryol. Mex. 34. 1871.

Robust plants forming deep, lax tufts, yellowish green above, brown below. Stems to 8 cm. long, branched, densely foliate. Leaves erect-spreading with tightly curled points when dry, squarrose-spreading when moist, 4–5 mm. long, linear-lanceolate from an erect, concave, clasping, oblong-ovate base, acuminate, with a dis-

tinct border of elongate, pellucid cells extending more than half way up the leaf margins; margins erect, undulate, denticulate with irregular teeth to below the leaf shoulders; costa percurrent; inner basal cells linear with firm, pellucid lateral walls, laxly rectangular and pellucid in 6 or 7 rows at margins, gradually merging above with the small, subquadrate, densely papillose lamina cells, border near mid-leaf 3–4 rows wide of narrowly rectangular, pellucid cells with slightly porose, pale, incrassate walls, sharply defined from the small, obscure lamina cells. (Fig. 46, A–D.)

Dept. Huehuetenango: *Sharp 4848, 4864, 4970, 5361.*

Distribution: Mexico, Ecuador.

On calcareous boulders and soil at moderately high altitudes. Distinguished from *P. squarrosa* (Brid.) Lindb. by the more robust habit, elongated inner basal cells and the hyaline border extending farther up the margins. No. 4864 in the above series approaches *P. squarrosa* in the shorter interior basal cells but the hyaline border extends higher up the leaf as in *P. luteola.*

15. TRICHOSTOMOPSIS Card., Rev. Bryol. **36**: 73. 1909.

Small, tufted, green plants; stems short. Leaves crowded, crisped when dry, lanceolate, acute; margins lightly reflexed; costa per-

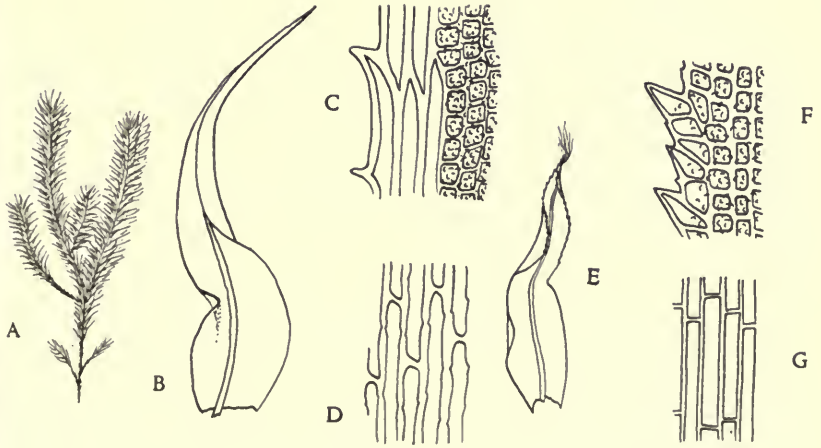

FIGURE 46

A–D, *Pleurochaete luteola:* A, plant, ×⅔; B, leaf, ×12; C, upper leaf cells and margin above mid-leaf, ×340; D, basal leaf cells, ×340.

E–G, *Leptodontium excelsum:* E, leaf, ×12; F, cells and margin near mid-leaf, ×400; G, basal leaf cells, ×400.

current, with stereid band on dorsal side only; upper cells papillose, often bistratose, basal cells rectangular, hyaline. Seta terminal, elongate; capsules erect; peristome teeth divided nearly to base into 2 filiform, papillose forks, slightly twisted.

1. TRICHOSTOMOPSIS DIAPHANOBASIS (Card.) Grout, Moss Fl. of No. Amer. **1**: 228. 1939.

Didymodon diaphanobasis Card., Rev. Bryol. **37**: 125. 1910.

Plants densely tufted, brownish green above, paler below. Stems about 1 cm. high. Leaves contorted when dry, 1.5–2 mm. long, lanceolate, acute; costa percurrent; upper cells rounded, papillose, 10–12 μ, bistratose at margins, basal cells lax, rectangular, hyaline. Seta 7–8 mm. long; capsule ovoid-cylindric, urn about 2 mm. long; peristome teeth slightly twisted, about 0.5 mm. long; lid conic-rostrate. (Fig. 47, A–D.)

Dept. Quezaltenango: *Standley 66489a* in part, *66502*.

Distribution: Arizona, Texas, Mexico.

On rocks at high altitude. The lax, thin walled, hyaline cells of the leaf base and the leaf blade broader above may assist in separating this species from *Didymodon Godmanianus*.

16. LEPTODONTIUM Hampe, Linnaea **20**: 70. 1847.

Usually dioicous; slender to robust plants in lax tufts or mats. Stems short to very long, mostly laxly foliate. Leaves contorted or crispate when dry, lanceolate or lingulate, usually coarsely toothed above; costa strong, ending in or near apex, with a thick dorsal stereid band and a thinner band on the ventral face; lamina cells rounded, papillose, basal cells rectangular, hyaline. Perichaetial leaves sheathing; seta erect; capsules cylindric; peristome teeth 16, irregularly cleft; lid beaked.

1. Stems slender, often short, leaves less than 2.5 mm. long 2
   Stems robust, elongate, leaves over 2.5 mm. long 4

2. Leaves minutely denticulate ..... 1. *L. filescens*
   Leaves coarsely serrate 3

3. Leaves oblong-lingulate ..... 3. *L. Orcutti*
   Leaves linear-lanceolate ..... 2. *L. Valerianum*

4. Papillae of leaf cells multifid 5
   Papillae of leaf cells simple or forked 6

5. Inner basal leaf cells thin-walled, hyaline ..... 4. *L. gracile*
   Inner basal leaf cells firm, pellucid ..... 5. *L. subgracile*

6. Leaf base obovate.....6. *L. acutifolium*
Leaf base ovate..... 7

7. Lamina cells dense, basal cells with straight lateral walls.....7. *L. excelsum*
Lamina cells incrassate, basal cells with sinuose lateral walls..... 8

8. Leaves erect-spreading when moist, long and slenderly acuminate
10. *L. ulocalyx*
Leaves squarrose-recurved when moist, short acuminate..... 9

9. Papillae of leaf cells simple, low.....9. *L. sulphureum*
Papillae of leaf cells high, often forked.....8. *L. exasperatum*

1. LEPTODONTIUM FILESCENS (Hampe) Mitt., Journ. Linn. Soc. **12**: 50. 1869.

Trichostomum filescens Hampe, Linnaea **32**: 128. 1863.

Plants yellowish green. Stems slender, red, laxly foliate, to 1.5 cm. long. Leaves appressed and slightly contorted when dry, to 1.2 mm. long, oblong-ovate, acute, apiculate, keeled; margins recurved near mid-leaf, papillose-crenulate, slightly denticulate near apex; costa ending below apex, papillose on back; inner basal cells rectangular, incrassate, upper cells irregularly rounded, densely papillose, obscure. Seta 8–9 mm. long; capsule erect. (Fig. 47, E–I.)

Dept. Quezaltenango: *Standley 67663a.*

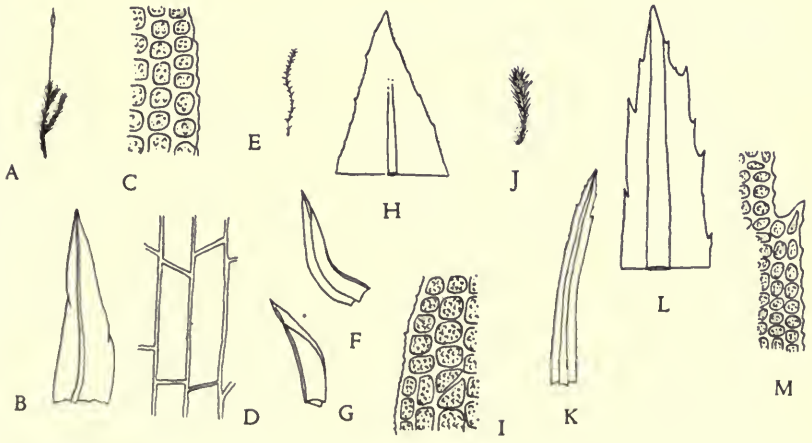

FIGURE 47

A–D, *Trichostomopsis diaphanobasis:* A, moist plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270; D, basal leaf cells, ×270.

E–I, *Leptodontium filescens:* E, moist plant, ×1; F and G, leaves, ×14; H, apex of leaf, ×120; I, upper leaf cells and margin, ×270.

J–M, *Leptodontium Valerianum:* J, plant, ×1; K, leaf, ×14; L, apex of leaf, ×120; M, upper leaf cells and margin, ×270.

Distribution: Mexico to Colombia.

On moist bank at high altitude. Rarely collected and usually sterile. The slender stems and small, subentire leaves are distinctive.

2. LEPTODONTIUM VALERIANUM Bartr., Journ. Wash. Acad. Sci. **19**: 18. 1929.

Slender, yellowish green plants; stems 1 cm. long or longer, densely tomentose below. Leaves incurved and contorted when dry, about 2 mm. long, linear-lanceolate, short acuminate; margins erect, coarsely and irregularly serrate above; costa strong, subpercurrent; upper cells 7–8 μ, densely papillose, occasionally in 2 layers near margins, basal cells oblong, pellucid. Sporophyte unknown. (Fig. 47, J–M.)

Dept. San Marcos: *Steyermark 35696a.*

Distribution: Costa Rica.

On moist, shaded bluffs at high altitude. This species has some anomalous characters but until the sporophyte is known it may be retained here.

3. LEPTODONTIUM ORCUTTI Bartr., Journ. Wash. Acad. Sci. **21**: 289. 1931.

Zygodon gracilis var. *americana* Grout, Moss Fl. No. Amer. **2**: 141. 1935.

Leptodontium flexifolium var. *americanum* Grout, Moss Fl. No. Amer. **1**: 171. 1938.

Slender plants, yellowish green above, brown below. Stems to 4 cm. long but usually shorter. Leaves contorted and incurved when dry, to 2 mm. long, oblong-lingulate, abruptly acute, keeled; margins slightly recurved, irregularly serrate above; costa ending below apex; upper cells rounded, 7–10 μ, densely papillose, 4–6 rows at margins often incrassate forming a pellucid border, basal cells rectangular. Seta about 12 mm. long, pale yellow; capsule suberect, cylindric, urn 2 mm. long; peristome teeth divided to base, forks lightly granulose; lid conic-rostrate. (Fig. 48, A–D.)

Dept. Huehuetenango: *Steyermark 50172.* Dept. San Marcos: *Steyermark 35523.* Dept. Totonicapan: *Standley 62667, 62685, 84512a, 84562.* Dept. Quezaltenango: *Standley 67687, 67715b, 67717, 67727a, 67731, 67739, 67759a, 86136, 86137; Steyermark 34164, 34165a.* Dept. Solola: *Steyermark 47496.* Dept. Chimaltenango: *Standley 58745, 60980, 61078.*

Distribution: North Carolina, Mexico, Costa Rica.

On trees, logs, banks and rocks at high altitudes. Until this genus is more critically studied I feel that it is more practical to

use the less cumbersome name for the North American plants which are obviously closely allied to *L. flexifolium* (Sm.) Hampe. In our plants the leaves are often conspicuously bordered, the spores average a little larger and there are slight differences in the sporophyte.

4. LEPTODONTIUM GRACILE C. M., Bull. Torr. Bot. Club **23**: 474. 1896.

Stems 3–4 cm. long, yellowish green at tips, brown below. Leaves crowded, strongly contorted when dry, about 4 mm. long, ovate, short acuminate; margins recurved about half way up, plane and irregularly serrate above; costa ending below apex; inner basal cells rectangular, lax, thin walled, hyaline, shorter and strongly papillose toward margins, changing abruptly above to the rounded upper cells which are strongly papillose with multifid papillae. Sporophyte unknown. (Fig. 48, E–H.)

Dept. Totonicapan: *Standley 62686, 62687, 84432, 84441, 84443, 84446.*

Distribution: Mexico, Costa Rica, Bolivia.

On damp banks at high altitudes. The large area of delicate, hyaline basal cells changing quickly to the small, chlorophyllose cells of the margins and to the similar lamina cells above is a noteworthy feature of this species.

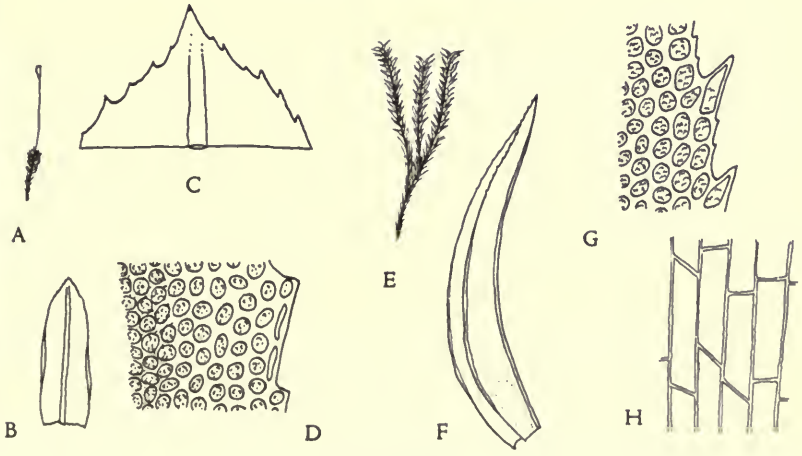

FIGURE 48

A–D, *Leptodontium Orcutti:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, upper leaf cells and margin, ×270.

E–H, *Leptodontium gracile:* E, plant, ×1; F, leaf, ×14; G, upper leaf cells and margin, ×270; H, inner basal leaf cells, ×270.

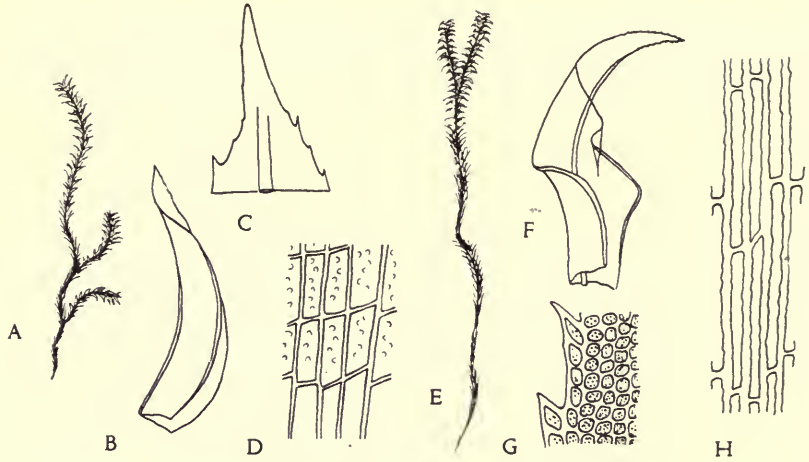

FIGURE 49

A–D, *Leptodontium subgracile:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, inner basal leaf cells, ×270.

E–H, *Leptodontium acutifolium:* E, plant, ×1; F, leaf, ×14; G, upper leaf cells and margin, ×270; H, inner basal leaf cells, ×270.

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5. LEPTODONTIUM SUBGRACILE Ren. & Card., Bull. Soc. Bot. Belg. **31**: 153. 1892.

Leptodontium brachyphyllum Broth. & Thér., Bull. Acad. Int. de Geog. Bot. 40. 1906.

Stems slender, flexuous, 3–8 cm. long or longer, yellowish green above. Leaves not crowded, appressed with contorted points when dry, spreading when moist, 2.5–5 mm. long, ovate-lanceolate, short acuminate; margins recurved more than half way up, irregularly serrate above; costa ending just below apex; basal cells linear with firm lateral walls, papillose nearly to insertion, upper cells densely papillose with multifid papillae. Sporophyte unknown. (Fig. 49, A–D.)

Dept. San Marcos: *Steyermark 35789.* Dept. Totonicapan: *Standley 83135.* Dept. Quezaltenango: *Steyermark 34163a.* Dept. Jalapa: *Steyermark 32244, 33119.*

Distribution: Mexico, Costa Rica, Colombia, Peru, Bolivia.

On dry and moist banks and trees at medium to high altitudes. The only noticeable difference between *L. subgracile* and *L. brachyphyllum* is in the length of the stems. Apparently the plants growing in moist habitats have longer stems while those found on dry or rocky banks have shorter stems. As the structural details are identical, I feel that they can safely be combined in one species.

6. LEPTODONTIUM ACUTIFOLIUM Mitt., Journ. Linn. Soc. **12**: 51. 1869.

Stems slender, to 10 cm. long, yellowish above, brown below. Leaves appressed and contorted when dry, widely spreading with decurved points when moist, 2.5–3 mm. long, lanceolate from an erect, obovate, clasping base, acuminate; margins recurved below, sharply serrate above; costa percurrent; basal cells linear with sinuose, incrassate lateral walls, upper cells 6–9 μ, papillose. Seta 1.25 cm. long; capsule ovoid-cylindric; lid short beaked. (Fig. 49, E–H.)

Dept. San Marcos: *Steyermark 35523a, 35524.* Volcan del Fuego, *Godman & Salvin* (type).

Distribution: Ecuador, Bolivia.

On dry ridges in pine woods at high altitudes. Clearly distinguished by the upwardly dilated leaf base, the narrow basal cells and the small, dense, obscure lamina cells.

7. LEPTODONTIUM EXCELSUM (Sull.) E. G. Britt., Bryol. **11**: 66. 1908.

Syrrhopodon excelsus Sull., Musc. Allegh. 170. 1848.

Holomitrium serratum (Schp.) C. M., Syn. **2**: 587. 1851.

Leptodontium brevisetum Mitt., Journ. Linn. Soc. **12**: 50. 1869.

Growing in intricate mats or masses, yellowish green at tips. Stems elongate, flexuous, profusely branched. Leaves strongly contorted when dry, widely spreading when moist, often radiculose at tips, about 3 mm. long, ovate-lanceolate, acuminate, deeply carinate, slightly decurrent; margins recurved below, erect and coarsely spinose-serrate at least half way down; costa short-excurrent; lamina cells small, dense, rounded-quadrate, slightly incrassate, finely papillose, diam. 5–6 μ near mid-leaf, larger toward apex, inner basal cells narrowly rectangular with straight lateral walls, smooth, pellucid, smaller toward margins. (Fig. 46, E–G.)

Dept. Quezaltenango: *Sharp 2314.*

Distribution: Southern Alleghenies, Mexico.

On tree at rather high altitude. Leptodontium is so broadly represented here that Guatemala may well be considered as the center of distribution for the genus. This is a noteworthy collection extending the range of the species well to the southward.

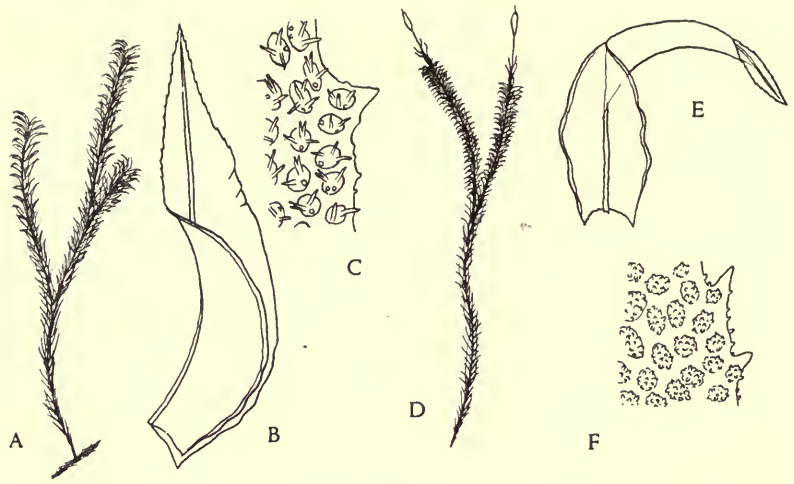

FIGURE 50

A–C, *Leptodontium exasperatum:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270.

D–F, *Leptodontium sulphureum:* D, plant, ×1; E, leaf, ×14; F, upper leaf cells and margin, ×270.

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8. LEPTODONTIUM EXASPERATUM Card., Rev. Bryol. **36**: 74. 1909.

Plants yellow above, brown below. Stems branched, to 6–8 cm. long. Leaves crowded, contorted when dry, squarrose-recurved when moist, to 4 mm. long, ovate, acuminate; margins broadly reflexed below, serrate above; costa percurrent, papillose on back; basal cells linear, sinuose, upper cells rounded, distinct, very incrassate, coarsely papillose with strong, simple or forked papillae about 10–12 μ high. Sporophyte unknown. (Fig. 50, A–C.)

Dept. Huehuetenango: *Steyermark 49956*. Dept. Totonicapan: *Standley 62664a* (as *L. sulphureum*).

Distribution: Mexico.

On trees at high altitudes. The more broadly reflexed leaf margins and especially the high, spine-like papillae of the leaf cells seem to be good diagnostic characters as compared with *L. sulphureum*.

9. LEPTODONTIUM SULPHUREUM (C. M.) Mitt., Journ. Linn. Soc. **12**: 51. 1869.

Trichostomum sulphureum C. M., Syn. **2**: 626. 1851.

Leptodontium helicoides Card., Rev. Bryol. **36**: 75. 1909.

Plants pale yellow; stems to 10 cm. long, branched. Leaves contorted when dry, squarrose-recurved when moist, 3–3.5 mm. long, sometimes indistinctly 3 ranked, slightly undulate, ovate-lanceolate, short acuminate; margins recurved below, serrate above; costa subpercurrent, minutely papillose on back; basal cells linear, incrassate, with sinuose lateral walls, upper cells rounded, incrassate, densely papillose with low, rounded papillae scarcely 3 μ high. Perichaetial leaves 7–8 mm. long, sheathing, laxly areolate, cells elongate, lateral walls straight or only slightly sinuose; seta 7 mm. long, pale yellow; capsule ovoid-cylindric, urn 3.5 mm. long; lid 1 mm. long; peristome teeth about 0.1 long, pale, nearly smooth, indistinctly articulate; spores 20–30 μ. (Fig. 50, D–F.)

Dept. Quiche: *Standley 62471, 62539.* Dept. Huehuetenango: *Standley 62629a, 82720, 83084a; Steyermark 50508.* Dept. San Marcos: *Standley 68589, 86314* (in prime fruit). Dept. Totonicapan: *Standley 84514.* Dept. Quezaltenango: *Steyermark 33942; Standley 67840, 83678* (as *L. ulocalyx*), *85653.* Dept. Chimaltenango: *Standley 57827* (as *L. ulocalyx*). Dept. Guatemala: *Standley 80570* (as *L. ulocalyx*). Dept. Jutiapa: *Standley 75933* (as *L. ulocalyx*), *76423* (as *L. ulocalyx*). Dept. Zacapa: *Steyermark 42319a.* Dept. Jalapa: *Standley 75583, 76849, 77303.*

Distribution: Mexico, Nicaragua, Costa Rica, Bolivia.

On damp, shaded banks and trees at medium to high altitudes. The pale yellow or yellowish green color, the shorter, broader leaf points and the leaves more decurved when moist will help to separate this species from *L. ulocalyx.* Occasional collections with more slenderly pointed leaves are puzzling but whether these are hybrids or intermediate forms I do not know.

10. LEPTODONTIUM ULOCALYX (C. M.) Mitt., Journ. Linn. Soc. **12**: 51. 1869.

Trichostomum ulocalyx C. M., Syn. **1**: 578. 1849.

Trichostomum Sartorii C. M., Linnaea **38**: 637. 1874.

Leptodontium perannulatum Williams, Bull. Torr. Bot. Club **34**: 572. 1907.

Plants usually more slender than *L. sulphureum* and with a more decided brownish cast. Leaves slenderly acuminate, less strongly decurved when moist. Perichaetial leaves similar to *L. sulphureum* but with firmer cells and more thickened, sinuose lateral walls; capsules to 4 mm. long; annulus broad and persistent. (Fig. 51, A–D.)

Dept. Alta Verapaz: *Standley 92603.* Dept. Huehuetenango: *Standley 81117, 81695, 81698.* Dept. San Marcos: *Steyermark 36094, 36096.* Dept. Totonicapan: *Standley 62729a, 84512, 84535a.* Dept. Quezaltenango: *Steyermark 34122, 34869b, 34851, 34914a; Standley 67660a, 67663b, 67675, 67756, 83741.* Dept. Sacatepequez:

Standley 65275. Dept. Chimaltenango: *Standley 60949b, 61844b, 61858, 61869, 61870.* Dept. Guatemala: *Standley 80608, 80732a.* Dept. El Progresso: *Steyermark 43114.* Dept. Jalapa: *Steyermark 32461, 33054.*

Distribution: Mexico, Costa Rica, Venezuela.

On banks, trees and rocks at medium to high altitudes. This species and *L. sulphureum* are closely allied. The distinctions are relative only and not sharp. I am tempted to keep them separate but am doubtful if the distinctions will hold. An extreme variant is represented by the following variety.

LEPTODONTIUM ULOCALYX var. CIRRIFOLIUM (Mitt.) Bartr., *comb. nov.*

Leptodontium cirrifolium Mitt., Journ. Linn. Soc. **12**: 52. 1869.

Stems longer, to 15–20 cm. long. Leaves with strongly contorted, crispate points when dry, long and slenderly acuminate.

Dept. Totonicapan: *Standley 62708, 62722a.* Dept. Solola: *Steyermark 47455, 47458a.*

Distribution: Panama, Ecuador.

On banks at high altitudes. The longer stems and the relatively longer more slender, crispate leaf points seem to be the only differences between this form and typical *L. ulocalyx.*

17. HYOPHILA Brid., Bryol. Univ. **1**: 760. 1826.

Dioicous; small, tufted, green or brownish plants. Stems branched. Leaves crowded, when dry contorted with incurved margins, lingulate or spatulate, acute or obtuse, entire or weakly toothed above; costa ending in or near apex; upper cells subquadrate, basal cells rectangular. Seta terminal, erect; capsule exserted, erect; peristome lacking; lid beaked.

Upper leaf cells distinct, slightly papillose, seta 5–10 mm. long.....1. *H. tortula*
Upper leaf cells obscure, densely papillose, seta 2–3 mm. long...2. *H. microcarpa*

1. HYOPHILA TORTULA (Schwaegr.) Hampe, Bot. Zeit. 1846: 267. 1846.

Gymnostomum tortula Schwaegr., Suppl. 2^2: 78. 1827.
Pottia riparia Aust., Musc. Appl. 112. 1870.
Pottia denticulata C. M., Bull. Herb. Boiss. **5**: 190. 1897.
Pottia subcrenulata C. M., Bull. Herb. Boiss. **5**: 190. 1897.
Pottia reflexifolia C. M., Bull. Herb. Boiss. **5**: 190. 1897.

Stems 2 or 3 cm. high, frequently with clusters of stalked, multicellular brood bodies in axils of comal leaves. Leaves oblong, lingu-

late or spatulate, short pointed, 2–3 mm. long; margins inflexed below, plane above, often with several coarse, distant teeth near apex; costa usually percurrent in a short, concolorous apiculus; upper cells rounded, distinct, 8–12 μ, with firm walls, slightly papillose, basal cells rectangular. Seta about 1 cm. long, reddish; capsule cylindric, urn 1.5–2 mm. long; lid 0.5 mm. long; annulus wide. (Fig. 51, E–G.)

Dept. Peten: *Steyermark 45910, 45911; Lundell 2020.* Dept. Izabal: *Standley 73010; Steyermark 39922.* Dept. Alta Verapaz: *Steyermark 44762.* Dept. Huehuetenango: *Standley 82217, 82902.* Dept. Quezaltenango: *Steyermark 33929a.* Dept. Retalhuleu: *Standley 88544.* Dept. Sacatepequez: *Standley 62234.* Dept. Chimaltenango: *Standley 64514.* Dept. Chiquimula: *Steyermark 31122.* Dept. Jalapa: *Standley 76802, 76816, 77210.* Dept. Santa Rosa: *Standley 77966.*

Distribution: Eastern United States, Arizona, Mexico, West Indies, Central America, Brazil.

On damp rocks at low altitudes. A common and variable species in the American tropics where it fruits freely. The synonymy is quite extensive.

2. HYOPHILA MICROCARPA (Schimp.) Broth., E. & P. Pflanzenf. 1[3]: 403. 1902.

Trichostomum microcarpum Schimp., Ann. Sci. Nat. Ser. 6, 3: 198. 1876.

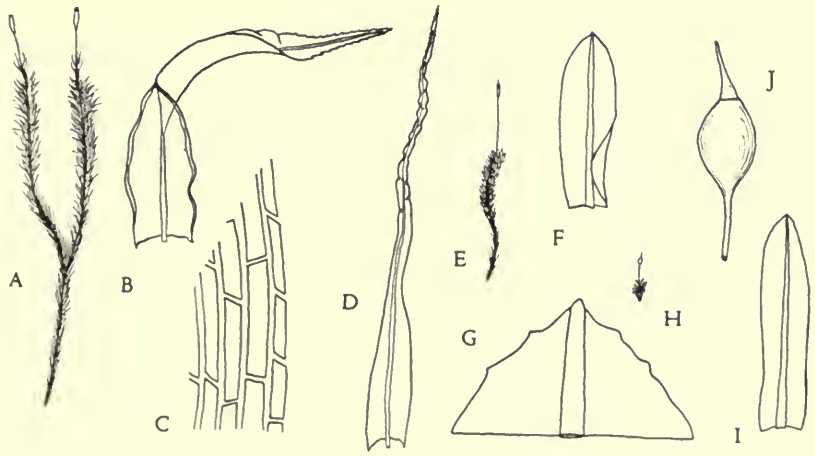

FIGURE 51

A–D, *Leptodontium ulocalyx:* A, plant, ×1; B, leaf, ×14; C, inner basal leaf cells, ×270; D, leaf of var. *cirrifolium*, ×6.

E–G, *Hyophila tortula:* E, plant, ×1; F, leaf, ×12; G, apex of leaf, ×120.

H–J, *Hyophila microcarpa:* H, plant, ×1; I, leaf, ×14; J, capsule, ×14.

Dioicous; stems less than 5 mm. high. Leaves crowded, incurved and contorted when dry, to 2 mm. long, oblong-lanceolate, acute; margins erect or slightly inflexed; costa percurrent; upper cells small, dense, papillose, obscure and opaque, basal cells oblong, smooth, pellucid. Seta 2–3 mm. long; capsules short ovoid to subglobose, urn scarcely 1 mm. long; lid obliquely rostrate, 0.5 mm. long. (Fig. 51, H–J.)

Dept. Jutiapa: *Standley 75228.*

Distribution: Guadeloupe, Martinique.

On damp bank at moderate altitude. These plants are apparently dioicous. No antheridia were found but the buds seen are all purely archegonial. The leaves are rather more bluntly pointed than in the Martinique plants but the sporophyte characters agree perfectly.

18. WEISIOPSIS Broth., Ofv. Finska Vet.-Soc. Forh. 62, Avd. A, No. **9**: 7. 1920.

Autoicous; small terrestrial plants in extensive colonies. Leaves contorted when dry, long lingulate, broadly rounded; margins plane; costa ending below apex; lamina cells small, papillose, basal cells rectangular, pellucid, smooth. Seta erect, slender; capsule ovoid-cylindric, erect; peristome teeth linear-subulate, erect, finely papillose; lid conic-rostrate.

1. WEISIOPSIS OBLONGA Thér., Rev. Bryol. et Lich. **5**: 95. 1932.

Stems to 3 mm. high, simple or branched, yellowish green above, paler below, sparsely radiculose. Leaves with incurved, strongly contorted points when dry, erect-spreading when moist, 1.5–1.8 mm. long, oblong-lingulate, broadly rounded or truncate, carinate-concave; margins erect, papillose-crenulate; costa pale, ending below apex; upper cells rounded-hexagonal, diam. 10 μ, scarcely incrassate, highly convex, smooth, inner basal cells lax, rectangular, thin-walled, pellucid, to 20 μ wide, narrower toward margins. Seta very slender, pale yellow, to 6 mm. long; capsule erect, urn 0.6–1 mm. long; peristome teeth slender, red, well spaced, 0.2 mm. long, 15 μ wide at base, papillose; lid rostrate, oblique, 0.5 mm. long. (Fig. 52, A–C.)

Dept. Huehuetenango: *Sharp 4981.*

Distribution: Mexico.

On bank at moderately high altitude. The lingulate, plane-margined, broadly rounded leaves in combination with the relatively long, widely spaced peristome teeth should simplify the recognition

of this attractive and rare little moss previously known only from the type locality in Mexico.

19. DIDYMODON Hedw., Sp. Musc. 104. 1801.

Small to moderately robust, tufted plants; stems branched, radiculose below. Leaves crowded, erect-spreading, lanceolate; margins recurved; costa strong, with dorsal and ventral stereid bands; upper cells small, papillose, elongated and smooth below. Seta elongate; capsules oblong to cylindrical; peristome teeth entire or divided, not twisted; lid conic-rostrate.

1. Capsules curved.....2. *D. campylocarpus*
   Capsules erect..... 2
2. Leaves apiculate, usually toothed near apex.....1. *D. recurvirostris*
   Leaves not apiculate, entire..... 3
3. Leaf margins erect, basal cells hyaline, delicate.....3. *D. alticaulis*
   Leaf margins recurved, basal cells with firm walls..... 4
4. Leaves lanceolate or lingulate, rounded-obtuse, costa ending below apex 6. *D. tophaceus*
   Leaves ovate-lanceolate, costa percurrent or excurrent..... 5
5. Leaf apex blunt, costa percurrent.....5. *D. fusco-viridis*
   Leaf apex sharp, costa ending in subula or excurrent.....4. *D. Godmanianus*

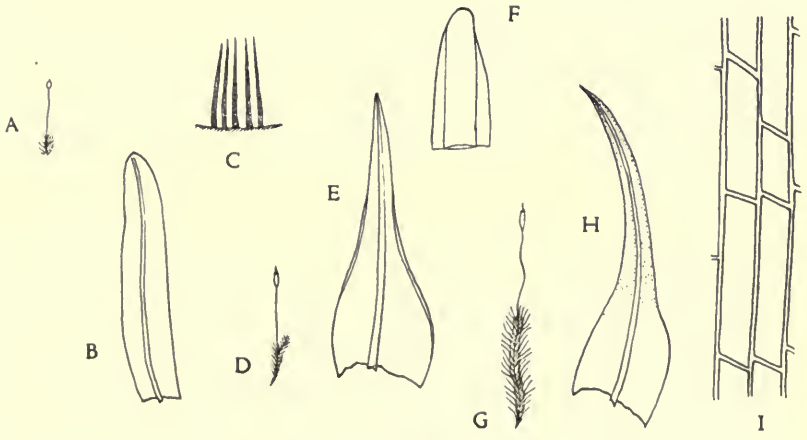

FIGURE 52

A–C, *Weisiopsis oblonga:* A, plant, ×1; B, leaf, ×20; C, part of peristome, ×54.
D–F, *Didymodon fusco-viridis:* D, plant, ×1; E, leaf, ×22; F, apex of leaf, ×120.
G–I, *Didymodon alticaulis:* G, plant, ×1; H, leaf, ×12; I, basal leaf cells, ×400.

1. DIDYMODON RECURVIROSTRIS (Hedw.) Jennings, Man. Mosses West. Pa. 97. 1913.

Weissia recurvirostra Hedw., Sp. Musc. 71. 1801.

Trichostomum aeneum C. M., Syn. **2**: 628. 1851.

Trichostomum leucodon C. M., Bull. Herb. Boiss. **5**: 192. 1897.

Synoicous; slender, tufted plants, yellowish green at tips, reddish brown below. Stems to 4–5 cm. high. Leaves crisped when dry, to 3 mm. long, linear-lanceolate from an erect, pale, clasping base, apiculate; margins revolute nearly to apex, strongly to obscurely toothed near the point; costa ending near apex; basal cells narrowly rectangular, hyaline, upper cells small, papillose, obscure. Seta 15–18 mm. long, slender, red; capsule suberect, cylindrical, urn to 3 mm. long; peristome teeth linear, reddish, rarely split; lid about 1 mm. long. (Fig. 53, A–C.)

Dept. Huehuetenango: *Steyermark 50268a*. Dept. San Marcos: *Steyermark 35732, 36092*. Dept. Totonicapan: *Standley 84029a*. Dept. Quezaltenango: *Standley 67627a, 67665, 67705a, 84274, 84318, 84340, 86004, 86145; Steyermark 34055, 34092, 34093, 34147, 34249, 34598, 34611, 35151*. Dept. Sacatepequez: *Standley 65244, 65246a*. Volcan de Agua, *Godman & Salvin* (as *D. aeneum*).

Distribution: Greenland to Alaska south to New Jersey, Iowa, New Mexico and Arizona, Mexico, wide in Europe, Asia, Africa, New Guinea, Tasmania, New Zealand.

On soil, rocks and trees in limestone regions at medium to high altitudes. This species may usually be recognized by the rusty-red coloring, the sharply apiculate leaves and toothed apical margins. *D. aeneus* (C. M.) Besch. has been credited to Guatemala but as far as I can see it is only a robust form of *D. recurvirostris*. The inflorescence of *D. aeneus* is monoicous but this alone is hardly a specific character. From the description *T. leucodon* seems to belong here also.

2. DIDYMODON CAMPYLOCARPUS (C. M.) Broth., E. & P. Pflanzenf. 1^3: 405. 1902.

Trichostomum campylocarpum C. M., Syn. **2**: 628. 1851.

?Barbula Jamesoni Tayl., Lond. Journ. Bot. **1846**: 48. 1846.

?Syrrhopodon Jamesoni Tayl., Lond. Journ. Bot. **1847**: 331. 1847.

Tortula arcuata Mitt., Journ. Linn. Soc. **12**: 163. 1869.

Plants similar in appearance and coloring to the smaller forms of *D. recurvirostris*. Stems about 1 cm. high. Leaves strongly contorted when dry, 1.5–2 mm. long, broadly linear from a slightly wider base, acute, apiculate; costa ending below apex; margins plane above,

toothed near apex, recurved on one side below; inner basal cells laxly rectangular, thin walled, hyaline or slightly colored, changing abruptly to the chlorophyllose cells of the basal margins and the small, subquadrate, papillose cells of the blade. Seta slender, red, 12–15 mm. long; capsules short, cylindrical, curved, wide-mouthed, urn 1.5 mm. long; peristome teeth red, from a short basal membrane, irregularly cleft. (Fig. 53, D–G.)

Dept. Quezaltenango: *Standley 67765.*

Distribution: Mexico, Costa Rica, Colombia, Ecuador.

On damp bank at rather high altitude. In addition to the shorter, plainly arcuate capsules this species differs from *D. recurvirostris* in the relatively broader leaf blade with the margins plane above the calymperoid base. I have not seen the type of *Barbula Jamesoni* Tayl. but if this and *Syrrhopodon Jamesoni* Tayl. prove to be the same as *D. campylocarpus*, as I suspect, there is no apparent reason why *D. Jamesoni* (Tayl.) should not be the acceptable name.

3. DIDYMODON ALTICAULIS Bartr., Bryol. **50**: 204. 1947.

Relatively robust, bright green plants in dense tufts. Stems to 1.5 cm. high. Leaves crowded, strongly contorted with circinate tips when dry, 3–4 mm. long, linear-lanceolate from a pale, clasping base, blunt at apex; margins erect, entire; costa percurrent; basal cells narrowly rectangular, delicate, hyaline, upper cells very obscure, densely papillose, diameter 10 μ, in one layer. Seta slender, flexuous, reddish below, paler above; capsule oblong-cylindrical, urn 2 mm. long; peristome teeth erect, to 0.5 mm. long, irregularly cleft; lid conic-rostrate, 1.5 mm. long. (Fig. 52, G–I.)

Dept. El Quiche: *Sharpe 5286.*

Endemic.

Boulder in river bed at moderate altitude. Suggestive of *Trichostomopsis diaphanobasis* (Card.) Grout in the delicate, hyaline areolation of the leaf base but widely different in the costal structure with thick stereid bands on both sides of the median guide row and also in the unistratose lamina cells.

4. DIDYMODON GODMANIANUS (C. M.) Bartr., Bryol. **49**: 113. 1946.

Barbula Godmaniana C. M., Bull. Herb. Boiss. **5**: 193. 1897.

Tortula campylocarpa Mitt. (nec Tayl.), Journ. Linn. Soc. **12**: 159. 1869.

?Barbula strictidens C. M., Bull. Herb. Boiss. **5**: 193. 1897.

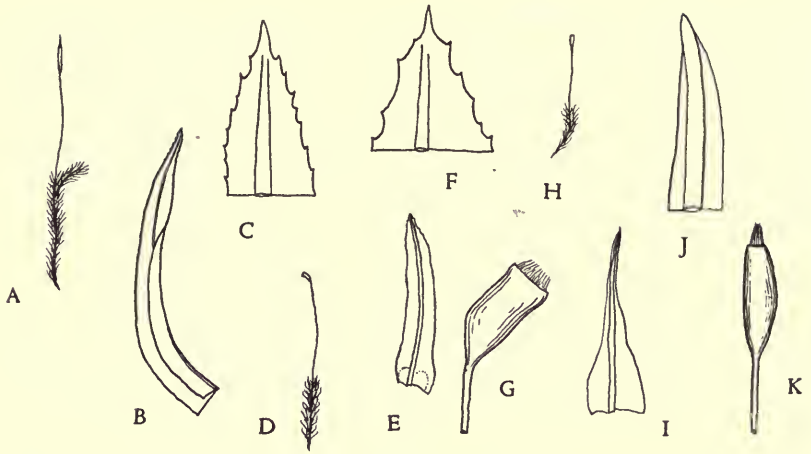

FIGURE 53

A–C, *Didymodon recurvirostris:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120.

D–G, *Didymodon campylocarpus:* D, plant, ×1; E, leaf, ×14; F, apex of leaf, ×120; G, capsule, ×8.

H–K, *Didymodon Godmanianus:* H, plant, ×1; I, leaf, ×14; J, apex of leaf, ×120; K, capsule, ×8.

Small, pale, slender plants; stems 5–6 mm. high. Leaves crispate when dry, about 2 mm. long, linear-lanceolate from a broader, ovate base, acuminate; margins entire, recurved below; costa ending in the fleshy, subulate point or excurrent; cells distinct, rounded, incrassate, papillose, 8–10 μ, more elongate near costa at base. Seta 6–8 mm. long, reddish; capsule erect, urn cylindric, narrowed at mouth, 1–2 mm. long; peristome teeth erect, deeply divided, about 0.3 mm. long; lid 1 mm. long. (Fig. 53, H–K.)

Volcan de Fuego, *Godman & Salvin.* Dept. Sacatepequez: *Standley 58531* in part (as *Trichostomopsis diaphanobasis*).

Endemic.

On old bricks at moderate altitude. Standley's 58531 differs in no way from the type collection. The peristome teeth are erect and the species should therefore be included in *Didymodon.* I have not seen the specimens from Ecuador which Mitten cites under *T. campylocarpa* Tayl. but have examined a part of the Godman & Salvin collection upon which Müller bases his species. It is possible that *B. strictidens* belongs here but no material is available for comparison.

5. DIDYMODON FUSCO-VIRIDIS Card., Rev. Bryol. **36:** 83. 1909.

Small, densely tufted, dark olive green plants. Stems 5–8 mm. high, densely foliate. Leaves erect and slightly contorted when dry, widely spreading when moist, 1–1.5 mm. long, ovate-lanceolate, blunt at apex, carinate-concave; margins entire, narrowly recurved near mid-leaf; costa strong, percurrent; leaf cells chlorophyllose, the upper small, rounded, faintly papillose, basal cells short-rectangular with firm, pale walls. Seta red, 8 mm. long; capsule ovoid-cylindric, dark brown; lid conic-rostrate, 0.6 mm. long; peristome teeth pale brown, erect, 0.3 mm. long. (Fig. 52, D–F.)

Dept. Solola: *Svihla 2888.*

Distribution: Mexico.

On rock at moderate altitude. The shorter, bluntish leaf points will hardly fail to separate this species from *D. Godmanianus* (C. M.). Here as in the type collection from Mexico spherical, brown, axillary propagula are often abundant.

6. DIDYMODON TOPHACEUS (Brid.) Jur., Laubm. 100. 1882.

Trichostomum tophaceum Brid., Method. Musc. 84. 1822.

Dioicous; plants in dense, dull, olive green tufts, brown below. Stems to 3 cm. or more long. Leaves incurved when dry, ovate-lanceolate or lingulate, apex obtuse or rounded, entire; margins revolute below; costa strong, ending below apex; upper cells distinct, rounded, incrassate, slightly papillose, rectangular below. Seta 8–12 mm. long, red; capsules cylindric, glossy; peristome teeth irregularly divided, variable; lid conic-rostrate. (Fig. 54, A–D.)

Dept. Huehuetenango: *Standley 65640, 81586* (as *Gyroweisia obtusifolia*), *82407* (as *Gyroweisia obtusifolia*). Dept. Quezaltenango: *Steyermark 34985* (as *Gyroweisia obtusifolia*). Dept. Sacatepequez: *Standley 58979* in part (as *Gyroweisia obtusifolia*).

Distribution: New York to British Columbia south to Tennessee and Arizona, Mexico, Bolivia, Europe, Asia, Africa.

On damp banks in limestone regions at moderate altitudes. A variable species but usually easily recognized by the rounded or bluntly pointed leaves with the costa ending below the apex. Dr. Andrews has a significant note on this species in The Bryologist, **44**, p. 105. 1941.

20. BARBULA Hedw., Sp. Musc. 115. 1801.

Dioicous; small or medium sized, tufted plants partial to calcareous soil or rocks, yellowish or brownish green. Stems erect.

Leaves lanceolate, usually contorted when dry; margins entire, mostly revolute; costa strong, percurrent or excurrent with dorsal and ventral stereid bands; upper cells small, usually papillose and obscure, basal cells more elongate and smooth. Seta elongate, erect; capsules cylindric; peristome teeth divided to base into 32 filiform, reddish forks, spirally twisted; lid long beaked; calyptra cucullate; spores small.

1. Upper leaf cells subquadrate, smooth, pellucid 2
   Upper leaf cells rounded or angular, mostly papillose 4
2. Leaves widest near middle, mucronate ..... 13. *B. agraria*
   Leaves widest at base, apex rounded or obtuse 3
3. Leaves narrowed from a wider base to a slender subulate point ..... 1. *B. subulifolia*
   Leaves gradually narrowed from a slightly wider base to a broadly ligulate point ..... 2. *B. stillicidiorum*
4. Leaves lanceolate, tapering to an acute apex (except *B. brunneola*) 5
   Leaves oblong or lingulate, apex obtuse, usually mucronate 11
5. Costa long excurrent 6
   Costa percurrent or nearly so 7
6. Leaves abruptly contracted to the subula, margins erect ..... 3. *B. icmadophila*
   Leaves gradually tapering, margins revolute ..... 4. *B. Bescherellei*
7. Leaves 4–6 mm. long, spirally contorted when dry, cells smooth ..... 5. *B. crassicostata*
   Leaves 2.5 mm. or less long, slightly curved when dry, cells papillose 8
8. Cells of ventral face of costa linear, distinct from lamina cells 9
   Cells of ventral face of costa similar to lamina cells 10
9. Leaves squarrose when moist, acuminate, costa percurrent ..... 8. *B. reflexa*
   Leaves erect-spreading when moist, rounded, costa ending below apex ..... 9. *B. brunneola*
10. Leaves erect-imbricated when dry, margins slightly recurved below ..... 6. *B. teretiuscula*
    Leaves curved with spreading points when dry, margins revolute to above middle ..... 7. *B. vinealis*
11. Perichaetial leaves convolute 12
    Perichaetial leaves not convolute 13
12. Stems 1–3 cm. high, perichaetial leaves acute ..... 10. *B. Pringlei*
    Stems under 1 cm. high, perichaetial leaves blunt ..... 11. *B. hypselostegia*
13. Leaves rounded, costa ending below apex ..... 12. *B. linguaefolia*
    Leaves mucronate, costa percurrent or excurrent 14
14. Leaf margin plane in upper half, recurved below ..... 14. *B. Cruegeri*
    Leaf margin strongly recurved from base nearly or quite to apex 15
15. Leaf margins spirally revolute to apex, basal cells smooth ..... 15. *B. spiralis*
    Leaf margins recurved to just below apex, cells papillose nearly to insertion ..... 16. *B. orizabensis*

1. BARBULA SUBULIFOLIA Sull., Proc. Am. Acad. **1861**: 277. 1861.

Plants densely tufted, pale or olive green above, brown below. Stems red, to 2 cm. long, slender. Leaves contorted when dry, 1.5–2 mm. long, subulate-lanceolate from a broader base, bluntly pointed; margins recurved below, denticulate at extreme apex; costa ending in or just below apex; upper cells irregularly quadrate, 6–10 μ, pellucid, smooth, basal cells rectangular. Seta red, 12–18 mm. long; capsule cylindric; peristome teeth red, spirally twisted in several turns, about as long as urn; lid long beaked, about as long as urn. (Fig. 54, E–H.)

Dept. Huehuetenango: *Steyermark 50791*. Dept. Chimaltenango: *Standley 80840, 80842*.

Distribution: Costa Rica, West Indies, Ecuador.

On wet banks and damp rocks at moderately high altitudes. A variable species with respect to the shape of the leaves and the form of the apex but readily distinguished by the smooth, quadrate, distinct upper leaf cells and the long, tightly twisted peristome.

2. BARBULA STILLICIDIORUM Card., Rev. Bryol. **37**: 126. 1910.

Plants similar to *B. subulifolia* in habit, coloring and structural details. Leaves broadly ligulate from a scarcely wider base, obtusely rounded and crenulate at apex. (Fig. 54, I–K.)

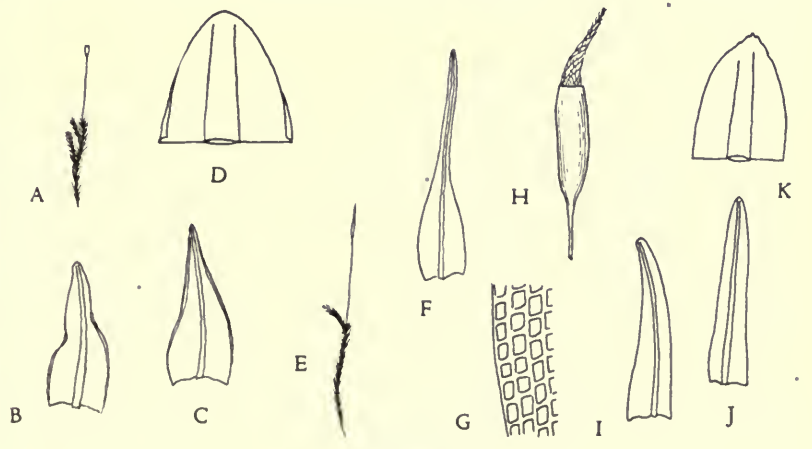

FIGURE 54

A–D, *Didymodon tophaceus:* A, plant, ×1; B and C, leaves, ×14; D, apex of leaf, ×120.

E–H, *Barbula subulifolia:* E, plant, ×1; F, leaf, ×14; G, upper leaf cells and margin, ×270; H, capsule, ×8.

I–K, *Barbula stillicidiorum:* I and J, leaves, ×14; K, apex of leaf, ×120.

Dept. Izabal: *Steyermark 38628, 39849.* Dept. Alta Verapaz: *Steyermark 46317; Standley 92003.* Dept. Retalhuleu: *Steyermark 34569.* Dept. Solola: *Standley 62769.* Dept. Chimaltenango: *Standley 64483, 64494, 80844, 80874, 80943.* Dept. Chiquimula: *Steyermark 30661.* Dept. Jalapa: *Steyermark 32235, 32276, 32915, 32917, 32920; Standley 76945.*

Distribution: Mexico, Porto Rico.

On wet banks and damp rocks at low to medium altitudes. Although distinct in the extreme this species is closely allied to *B. subulifolia* and may eventually have to be reduced to synonymy.

3. BARBULA ICMADOPHILA Schimp., Bry. Eur. fasc. **43.** Suppl. II. 1850.

Slender, brownish plants in lax tufts; stems 1–1.5 cm. long. Leaves appressed with spreading points when dry, not contorted, 1–1.5 mm. long, abruptly linear-subulate from an ovate base; margins erect, entire; costa long excurrent; cells rounded, incrassate, nearly smooth, slightly elongate near costa at base. Sporophyte not seen. (Fig. 55, E–G.)

Dept. San Marcos: *Steyermark 35816.*

Distribution: Canada, Montana, Europe, Asia.

On tree trunks at high altitude. The habitat is a peculiar one for this species and it is far out of its known range, but a careful comparison with authentic material leaves little doubt that it belongs here.

4. BARBULA BESCHERELLEI Sauerb. in Jaeg., Adumb. **2:** 673. 1878.

Plants green or often tinged with brown, laxly tufted. Stems slender, 1–4 cm. long. Leaves slightly contorted when dry, appressed or flexuous-spreading, 1.5–2 mm. long, ovate-lanceolate, subulate-acuminate; margins revolute; costa long excurrent; cells rounded, incrassate, lightly papillose, 7–9 μ, slightly larger and oblong near costa at base. Seta red, 1–2 cm. long; capsule cylindric; peristome teeth spirally twisted; lid long beaked. (Fig. 55, A–D.)

Dept. Huehuetenango: *Steyermark 50152a, 50456* (as *B. vinealis*), *82106.* Dept. Totonicapan: *Standley 83127* (as *B. teretiuscula*). Dept. Quezaltenango: *Standley 67599, 83378, 83399, 85802, 85975.* Dept. Sacatepequez: *Standley 59017, 65211.* Dept. Baja Verapaz: *Standley 69735.* Volcan de Fuego, *Godman & Salvin.* Dept. Santa Rosa: *Bernoulli 657.*

Distribution: Arizona, New Mexico, Mexico, Costa Rica.

On shaded banks and bases of trees mostly at high altitudes. Mitten's description of *Barbula rectifolia* Tayl. does not apply to

the collections of Godman & Salvin cited under this heading which show the leaves with a long, excurrent costa and structurally different in no important details that I can see from *B. Bescherellei.*

5. BARBULA CRASSICOSTATA Bartr., Bryol. **49**: 114. 1946.

Robust plants in deep tufts, dull yellowish green above, brown below. Stems 3–4 cm. high, sparingly radiculose below. Leaves spreading, strongly contorted with circinate points when dry, widely spreading when moist and somewhat falcate-secund at the tips, 5–6 mm. long, lamina fragile, gradually linear-lanceolate from a short, triangular-ovate base; margins entire, recurved below, erect above; costa stout, brown, 150 μ wide below, percurrent or excurrent in a short, fleshy point; leaf cells smooth and incrassate, short and subquadrate below, irregularly rounded above, diameter about 10 μ. Fruit unknown. (Fig. 55, H–K.)

Dept. San Marcos: Along road between San Sebastian at km. 21 and km. 8, 8–18 miles northwest of San Marcos, alt. 2,700–3,800 m., *Steyermark 35695* TYPE, *35715.*

Endemic.

Suggestive of *Pseudosymblepharis circinata* in general appearance but widely different in the shape and structure of the leaves. The

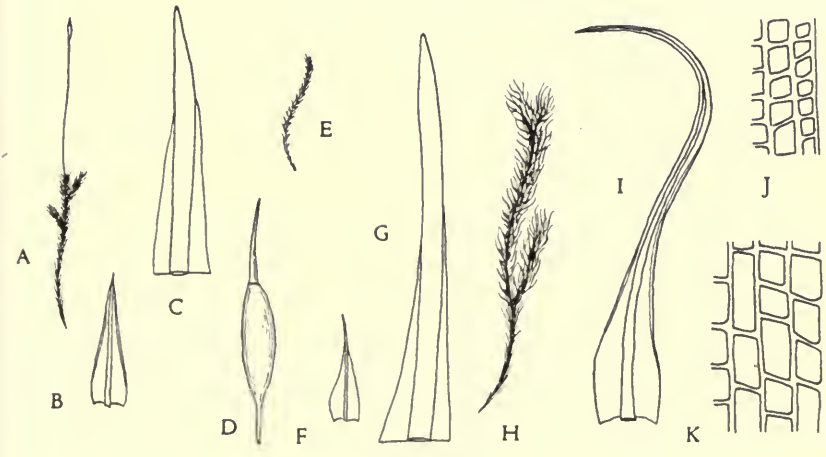

FIGURE 55

A–D, *Barbula Bescherellei:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, capsule, ×8.

E–G, *Barbula icmadophila:* E, plant, ×1; F, leaf, ×14; G, apex of leaf, ×120.

H–K, *Barbula crassicostata:* H, plant, ×1; I, leaf, ×12; J, upper leaf cells and margin, ×270; K, basal leaf cells, ×270.

short basal areolation and recurved margins are indicative of *Barbula* but without fruit one can only guess at its generic position.

6. BARBULA TERETIUSCULA Schimp., in C. M., Syn. **1**: 614. 1849.

Plants slender, laxly tufted, brownish; stems branched, subterete. Leaves rigidly erect, appressed, not contorted, 1–1.5 mm. long, ovate-lanceolate, acuminate; margins slightly recurved below; costa percurrent; upper cells rounded, 8–10 μ, papillose, oblong and pellucid near costa at base. Seta red, 6–8 mm. long; capsule ovoid-cylindric, urn 1.5 mm. long; peristome teeth reddish, twisted; lid conic-rostrate, 0.5 mm. long. (Fig. 57, A–D.)

Dept. Sacatepequez: *Standley 65262a.*

Distribution: Mexico.

At high altitude. The erect, closely imbricated leaves give the stems a characteristic look as compared with the other local species but apart from this the species has no particularly distinctive features.

7. BARBULA VINEALIS Brid., Bryol. Univ. **1**: 830. 1826.

Plants tinged with reddish brown, tufted; stems 1–3 cm. long. Leaves appressed and lightly twisted with spreading points when dry, about 2 mm. long, narrowly lanceolate from an ovate base, acuminate; costa stout, percurrent; margins recurved to above middle; upper cells small, dense and incrassate, larger and short rectangular below. Seta red, 10–12 mm. long; capsule cylindric, urn 2 mm. long; peristome teeth laxly twisted; lid conic-rostrate, to 0.7 mm. long. (Fig. 57, E–H.)

Dept. Huehuetenango: *Standley 81892* (c. fr.). Dept. Quezaltenango: *Standley 85251.* Dept. Jalapa: *Steyermark 32815?*

Distribution: Alaska to Mexico, east to Idaho and Montana, Europe, Asia, Africa.

On rocks at high altitudes. These are the first records of *B. vinealis* in Central America. The species is notoriously variable but the Guatemalan plants deviate in no essential way from the specific concept.

8. BARBULA REFLEXA (Brid.) Brid., Method. Musc. 93. 1822.

Tortula reflexa Brid., Musc. Recent Suppl. **1**: 255. 1806.

Slender, reddish-brown plants in dense, depressed tufts. Stems 2.5–3 cm. long, branched, decumbent, julaceous when dry. Leaves

crowded, imbricated when dry, squarrose-spreading when moist, 1.5 mm. long, ovate-lanceolate, short acuminate, strongly keeled, slightly decurrent; margins recurved to above mid-leaf; costa percurrent, showing linear cells on the ventral face in contrast to the small, papillose lamina cells, basal cells short, oval, incrassate, with pellucid walls, elongate only near insertion. Sporophyte rare, as in *B. fallax* Hedw. (Fig. 56, A–B.)

Dept. Huehuetenango: *Sharp 4940, 5020.*

Distribution: Northern United States and Canada south to Virginia, New Mexico and Colorado.

On calcareous bluffs and outcrops at high altitudes. These collections seem to be thoroughly typical of the species as it occurs in temperate regions and extend the known range appreciably to the southward.

9. BARBULA BRUNNEOLA C. M., Bull. Herb. Boiss. **5**: 196. 1897.

Very dark, rich brown plants, densely tufted but easily separated. Stems erect, to 1.5 cm. high, brittle, usually branched. Leaves appressed and imbricated when dry, spreading when moist, 1.5–2 mm. long, linear-lanceolate from an ovate base, bluntly rounded at the apex; margins recurved to above mid-leaf; costa strong, dark-brown, ending below apex; basal cells short rectangular with incras-

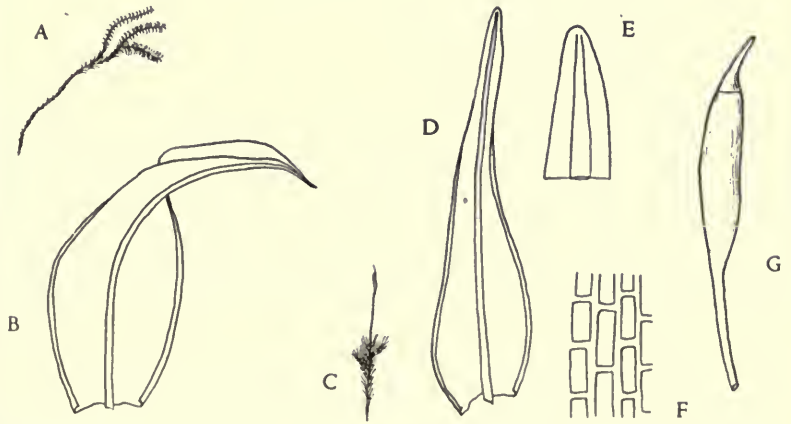

FIGURE 56

A–B, *Barbula reflexa:* A, plant, ×1; B, leaf, ×32.

C–G, *Barbula brunneola:* C, plant, ×1; D, leaf, ×28; E, apex of leaf, ×68; F, basal leaf cells, ×400; G, capsule, ×12.

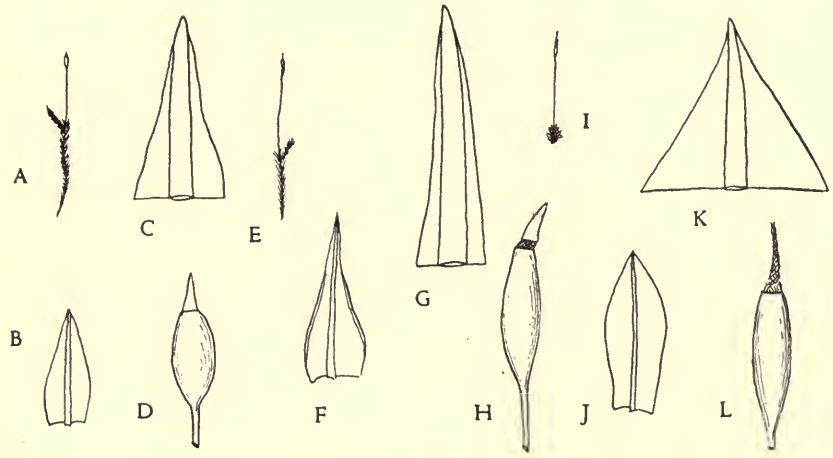

FIGURE 57

A–D, *Barbula teretiuscula:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, capsule, ×8.

E–H, *Barbula vinealis:* E, plant, ×1; F, leaf, ×14; G, apex of leaf, ×120; H, capsule, ×8.

I–L, *Barbula agraria:* I, plant, ×1; J, leaf, ×14; K, apex of leaf, ×120; L, capsule, ×8.

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sate, brownish walls, smooth, upper cells small, rounded, papillose. Perichaetial leaves erect, acuminate; seta dark brown, 6–7 mm. long; capsule cylindrical, urn 2 mm. long, dark brown; peristome 0.45 mm. high, teeth pale brown, twisted in about one turn; lid conic-rostrate, 1 mm. long. (Fig. 56, C–G.)

Dept. Huehuetenango: *Sharp 4966.*

Endemic.

On limestone boulders at high altitudes. No authentic material of this species is available for comparison, but as the above collection agrees perfectly with the original description and is likewise sharply distinct from any of the other local species, I feel reasonably confident in referring it here. The costa shows linear cells on the ventral face as in *B. reflexa* and *B. fallax* so the species is evidently closely allied to this group.

10. BARBULA PRINGLEI Card., Rev. Bryol. **36**: 85. 1909.

Plants to 3 cm. high, in dense tufts, yellowish green above, brown below. Stems branched, the sterile shoots often with axillary bulbils. Leaves contorted with incurved points when dry, 1.5 mm. long, 0.5 mm. wide, lingulate from an ovate base, obtuse, apiculate;

margins plane; costa very stout, brownish, excurrent in a minute apiculus; basal cells short, subquadrate, with pellucid, incrassate walls, slightly elongate near costa at extreme base, upper cells minute, opaque, obscure, papillose. Perichaetial leaves erect, convolute, acute; seta slender, 15 mm. long, reddish; peristome teeth 1 mm. long, twisted in several turns. (Fig. 58, A–D.)

Dept. Huehuetenango: *Sharp 4814, 4915.*

Distribution: Mexico.

On limestone bluff and outcrops at moderately high altitudes.

11. BARBULA HYPSELOSTEGIA Card., Rev. Bryol. **36**: 84. 1909.

Small, densely tufted plants similar to *B. Pringlei* but with shorter stems, rarely over 5–6 mm. high. Perichaetial leaves bluntly pointed.

Dept. Huehuetenango: *Sharp 4984.*

Distribution: Mexico.

On calcareous soil at moderately high altitude. In structural details these plants resemble *B. Pringlei* too closely for comfort. The sterile stems show the same ovoid, axillary bulbils, the leaves are relatively shorter and more broadly pointed, but the distinctions are far from sharp and the degree to which the perichaetial leaves are pointed varies considerably. On the whole I doubt if they can be maintained as separate species.

12. BARBULA LINGUAEFOLIA Bartr., Bryol. **50**: 204. 1947.

Laxly tufted, reddish brown plants. Stems erect, to 1 cm. high, laxly foliate. Leaves spreading, not contorted when dry, 1.5–2 mm. long, 0.5 mm. wide, lingulate, rounded-obtuse; margins recurved to above mid-leaf, plane and papillose-crenulate above; costa ending below apex; basal cells rectangular, thin-walled, smooth, upper cells rounded-quadrate, not incrassate, papillose. Seta slender, reddish, 10–12 mm. high; capsules curved when dry, erect when moist, narrowly cylindrical, urn 2 mm. long; lid 1 mm. long, subulate-rostrate; peristome teeth reddish, twisted in several turns. (Fig. 58, E–I.)

Dept. Suchiate: *Svihla 2879a.*

Endemic.

A unique and distinctive species comparable to no other North American Barbula that I am familiar with. The perfectly lingulate leaves with the costa ending below the broadly rounded apex are

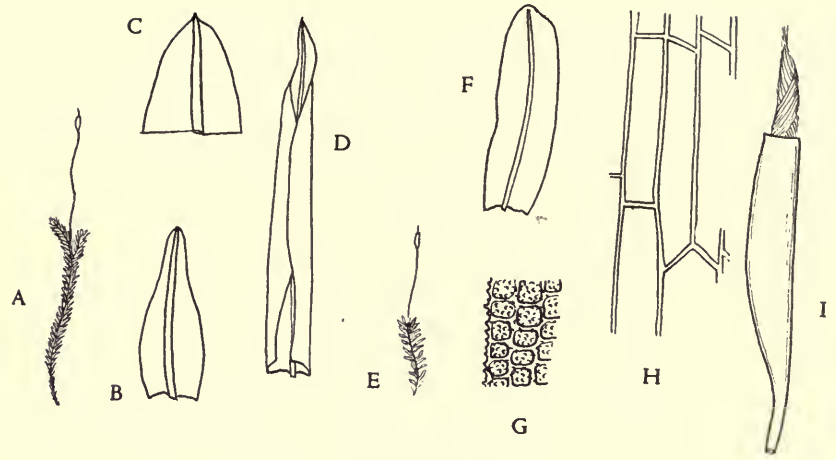

FIGURE 58

A–D, *Barbula Pringlei:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×68; D, perichaetial leaf, ×14.

E–I, *Barbula linguaefolia:* E, plant, ×1; F, leaf, ×14; G, upper leaf cells and margin, ×400; H, basal leaf cells, ×270; I, capsule, ×14.

suggestive of Tortula but the costa in cross section shows both dorsal and ventral stereid bands.

13. BARBULA AGRARIA Hedw., Sp. Musc. 116. 1801.

?Barbula subagraria C. M., Bull. Herb. Boiss. **5**: 195. 1897.

Small, gregarious, almost stemless plants. Leaves crowded in a terminal rosette, slightly contorted when dry, ovate-lanceolate, widest near middle, acute, concave, about 2 mm. long; margins erect; costa ending in the mucronate point; upper cells subquadrate, mammillose on ventral face, basal cells oblong, pellucid. Seta reddish, about 1 cm. long; capsule cylindric; peristome teeth long, twisted; lid long rostrate. (Fig. 57, I–L.)

Mazatenango: *Bernoulli 127* in part (as *B. subagraria* C. M.).

Distribution: Florida, Louisiana, Texas, Mexico, West Indies.

On calcareous soil and rocks. I have seen no material of this well-known species from Guatemala but Muller's description of *B. subagraria* leaves little doubt that it belongs here.

14. BARBULA CRUEGERI Sond. in C. M., Syn. **1**: 618. 1849.

Plants small, yellowish; stems red, less than 1 cm. long, rarely longer, usually with obovate, stalked propagula in the leaf axils.

Leaves contorted when dry, 1.5–2 mm. long, oblong-lanceolate, obtuse, mucronate; costa percurrent; margins narrowly recurved below, plane above; upper cells small, opaque, densely papillose, basal cells rectangular, incrassate, pellucid. Seta red; capsule oblong-cylindric; lid long beaked; peristome teeth red, closely twisted. (Fig. 59, A–D.)

Dept. Peten: *Bartlett 12543*. Dept. Jalapa: *Steyermark 32950*.

Distribution: New Jersey to Texas, Mexico, Costa Rica, West Indies, northern South America.

On damp banks at moderate altitudes. This species is apparently less common through Mexico and Central America than in the West Indies where it is widely distributed.

15. BARBULA SPIRALIS Schimp. in C. M., Syn. **1**: 622. 1849.

Barbula perlinealis C. M., Bull. Herb. Boiss. **5**: 195. 1897.

Medium sized plants, laxly tufted, dull yellowish green; stems to 2 or 3 cm. long, branched. Leaves spirally contorted when dry, 1.5–2.5 mm. long, oblong-lanceolate from a broader, pale base, obtuse, mucronate; margins strongly recoiled from near base to apex; costa very strong, broader above, excurrent in a short, pale mucro,

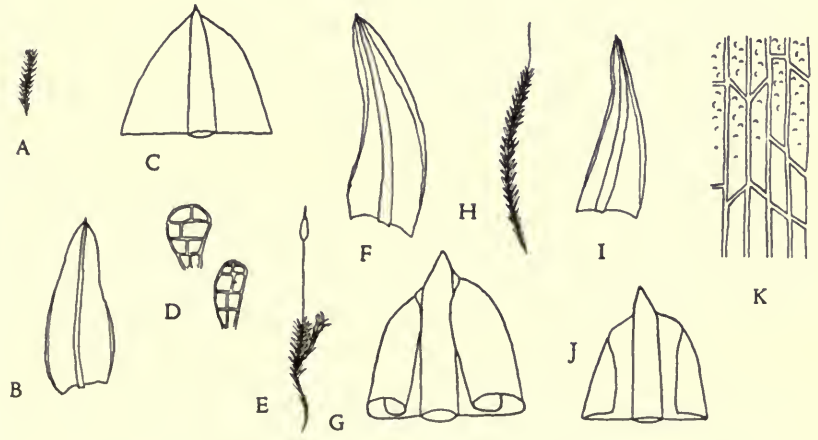

FIGURE 59

A–D, *Barbula Crugeri:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, propagula, ×120.

E–G, *Barbula spiralis:* E, plant, ×1; F, leaf, ×14; G, apex of leaf, ×120.

H–K, *Barbula orizabensis:* H, plant, ×1; I, leaf, ×14; J, apex of leaf, ×120; K, basal leaf cells, ×270.

papillose on back; upper cells small, densely papillose, very obscure, basal cells linear, smooth, pellucid toward costa, shorter and chlorophyllose toward margins. Seta reddish, 12–15 mm. long; capsule narrowly ovoid-cylindric, urn about 3 mm. long; peristome teeth tightly twisted; lid conic-rostrate, 1–1.5 mm. long. (Fig. 59, E–G.)

Dept. Totonicapan: *Standley 83157*. Dept. Quezaltenango: *Standley 66417, 66490, 66494, 66497a, 83888*. Dept. Zacapa: *Standley 74401*. Dept. Chiquimula: *Steyermark 30662*. Dept. Jalapa: *Steyermark 32816a; Standley 76707, 76777*.

Distribution: Arizona, New Mexico, west Texas, Mexico.

Dry, shaded banks and rocks at medium to high altitudes. The broadly revolute leaf margins extending from the apex nearly to the base and the large area of elongated, pellucid basal cells make this species easy of recognition.

16. Barbula orizabensis C. M., Linnaea **40**: 638. 1876.

Plants similar in size and appearance to *B. spiralis*. Leaves lanceolate from an ovate base, obtuse, mucronate; margins recurved from just above base nearly to apex, plane for a short distance below point; costa strong but not broader above, short excurrent; upper cells dense and opaque, basal cells rectangular, papillose almost to insertion. Small, globose, multicellular propagula are frequent if not constant in the upper leaf axils. Sporophyte not seen. (Fig. 59, H–K.)

Dept. Huehuetenango: *Standley 81224, 82428a, 82591, 82780, 82904, 83029a*. Dept. Guatemala: *Standley 62865*.

Distribution: Mexico.

On damp, shaded banks at moderately high altitudes. The distinctions between this species and *B. spiralis* are narrow but decisive. The papillose basal leaf cells and recurved but not revolute margins becoming flat just below the apex are constant characters.

EXCLUDED SPECIES

The following species are not available for comparison and cannot be accurately placed from the descriptions.

Barbula pellata Schimp., Bull. Herb. Boiss. **5**: 192. 1897.

Barbula lagunicola C. M., Bull. Herb. Boiss. **5**: 194. 1897.

Barbula suberythropoda C. M., Bull. Herb. Boiss. **5**: 194. 1897.

Barbula lonchostega C. M., Bull. Herb. Boiss. **5**: 195. 1897.

21. MORINIA Card., Rev. Bryol. **37**: 124. 1910.

Rather robust, tufted plants, resembling Tortula. Leaves erect and slightly contorted when dry, squarrose-recurved when moist, lanceolate, acute, carinate; margins revolute, thickened above, denticulate toward apex; costa strong, with stereid bands on both sides of the median guide row; upper cells small, densely papillose, basal cells rectangular, hyaline. Seta elongate; capsules cylindric; peristome teeth from a low basal membrane, divided to base, forks spirally twisted.

1. MORINIA EHRENBERGIANA (C. M.) Thér., Smiths. Misc. Coll. **85**[4]: 22. 1931.

Barbula Ehrenbergiana C. M., Syn. **1**: 636. 1849.

Barbula trichostomoides Besch., Prodr. Bryol. Mex. 38. 1871.

Morinia trichostomoides (Besch.) Card., Rev. Bryol. **37**: 124. 1910.

Dioicous; plants brown; stems to 3 or 4 cm. high. Leaves crowded, about 3 mm. long, strongly keeled, with a thickened border; margins revolute more than ⅔ up, irregularly denticulate for some distance below apex; costa brown, percurrent or short excurrent, smooth on back; upper cells rounded, about 8 μ, very obscure, 2–3 stratose in several rows at margins forming a distinct, thickened border, basal cells narrowly rectangular, thin walled, hyaline. Seta 8–10 mm. long, thick, reddish; capsules erect or slightly curved, urn 4 mm. long; lid conic-rostrate, 1.5 mm. long; peristome teeth reddish, tightly spiraled. (Fig. 60, A–D.)

Dept. San Marcos: *Steyermark 35564b, 35900.* Dept. Quezaltenango: *Standley 67601a.*

Distribution: Mexico.

On trees at high altitudes. The costal structure and the leaves with a thickened border, toothed toward apex, are distinctive characters in comparison with Tortula. Previously known only from Mexico.

22. STREPTOPOGON Wils. mss.; Mitt., in Lond. Journ. Bot. 51. 1869.

Medium sized, corticolous plants tinged with brown, in lax tufts; stems branched, laxly foliate. Leaves contorted when dry, often bordered; margins recurved below, entire or toothed; costa with a dorsal stereid band only, ending near apex or long excurrent; cells

lax, smooth and rectangular below, oval-hexagonal above. Seta short; capsules oblong-cylindric, exserted; peristome teeth from a low basal membrane, divided to base into 32 spirally twisted forks; lid long conic; calyptra conical, barely covering lid, scabrous with short, bristly hairs.

1. Leaves obtusely rounded, cucullate ..... 3. *S. cavifolius*
   Leaves acuminate 2
2. Leaves lanceolate, bordered ..... 1. *S. erythrodontus*
   Leaves oblong, unbordered ..... 2. *S. rigidus*

1. STREPTOPOGON ERYTHRODONTUS (Tayl.) Wils., in Lond. Journ. Bot. 51. 1851.

Barbula erythrodonta Tayl., Lond. Journ. Bot. 50. 1846.

Autoicous; stems to 3 cm. long. Leaves flexuous-spreading and spirally contorted when dry, 5–6 mm. long, lanceolate from an oblong, clasping base; margins recurved below, denticulate toward apex; costa excurrent in a denticulate arista; upper cells oval-hexagonal, to 50 μ long, more elongate below, basal cells narrowly rectangular; bordered all around with a narrow yellowish band of elongated cells clearly differentiated from the cells within. Seta 2–3 mm. long; capsule pale brown, urn 2–2.5 mm. long; lid rostrate, 1.5 mm. long; calyptra mitriform, hispid; peristome teeth red, twisted in several turns. (Fig. 60, E–G.)

Dept. Quezaltenango: *Standley 66350a.*

Distribution: Colombia, Ecuador, Peru, Bolivia, Hawaii, Madagascar, Africa.

On tree at high altitude. This is the first North American record for this interesting and attractive species.

2. STREPTOPOGON RIGIDUS Mitt., Bryol. **50**: 205. 1947.

Dioicous; plants brownish green. Stems simple, about 15 mm. high, densely foliate, slightly radiculose. Leaves slightly contorted when dry, rigidly erect-spreading when moist, 3 mm. long, 0.8 mm. wide, ovate-oblong, acuminate, concave, unbordered; margins entire, narrowly recurved almost to apex; costa stout, excurrent in a short, clavate point, crowned with dense, sphaerical clusters of elliptical, articulated propagula; upper cells hexagonal, smooth, thin-walled, to 16 μ wide, 32 μ long, smaller at margins, interior basal cells laxly rectangular, to 110 μ long, shorter toward margins. Fruit unknown. (Fig. 61, A–B.)

Dept. El Quiche: *Sharp 2425.* Dept. Baja Verapaz: *Sharp 2792, 2894, 2902.*

Distribution: Costa Rica, Colombia, Ecuador, Brazil.

On bark of trees at moderate altitudes. The name is apparently unpublished as no trace of it can be found in either Mitten's Musci Austro-Americani or in the Paris Index. It has become familiar through usage so it has seemed advisable to validate the combination. *S. peruvianus* Broth. may be the same thing but no authentic material is available for comparison.

In habit and coloring the plants are suggestive of Tortula but the sphaerical clusters of propagula at the tips of the proboscoid leaf apices are unique. Sharp's collections are uniformly sterile but abundant and in splendid condition. They will be a welcome addition to American herbaria as the species is known in North America only from a few meager collections from Costa Rica.

3. STREPTOPOGON CAVIFOLIUS Mitt., Journ. Linn. Soc. **12**: 180. 1869.

Stems 1 cm. or more long. Leaves erect and slightly contorted with incurved tips when dry, 2.5–3 mm. long, oblong, concave, unbordered, obtuse and cucullate at apex, often bearing numerous

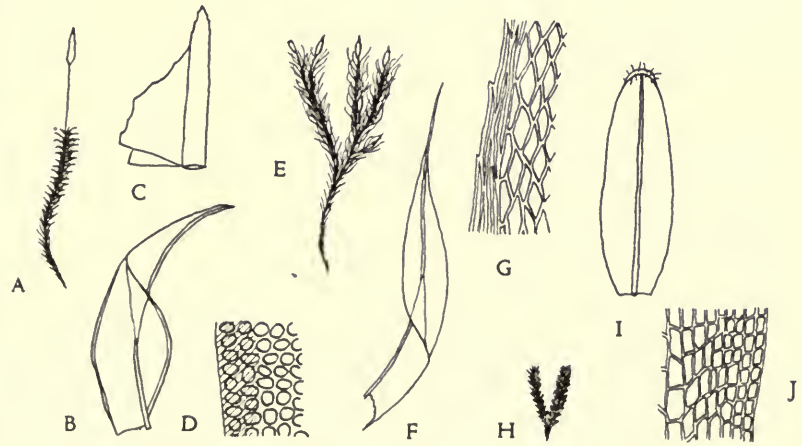

FIGURE 60

A–D, *Morinia Ehrenbergiana:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, upper leaf cells and margin, ×270.

E–G, *Streptopogon erythrodontus:* E, plant, ×1; F, leaf, ×8; G, upper leaf cells and margin, ×120.

H–J, *Streptopogon cavifolius:* H, plant, ×1; I, leaf, ×10; J, upper leaf cells and margin, ×120.

clavate or cylindrical, septate propagula on both faces near apex; upper cells oblong-hexagonal, thin walled, to 50 μ long and 20 μ wide, smaller toward margins, basal cells more elongate, rectangular, all with a persistent primordial utricle. Sporophyte unknown. (Fig. 60, H–J.)

Dept. Alta Verapaz: *Standley 69441a, 69566c.*

Distribution: Mexico, Colombia, Ecuador.

On trees in small tufts mixed with other mosses, at moderate altitude. This curious and very individual species is evidently quite rare. Mitten rather inaptly compares it to *S. erythrodontus* from which it differs widely in appearance and detail.

23. DESMATODON Brid., Musc. Rec. Suppl. **4**: 86. 1819.

Plants small or medium sized, usually tufted, terrestrial. Leaves incurved or slightly contorted when dry, oblong-lanceolate, broadly pointed, subentire; costa strong, ending in or near apex, with a stereid band on dorsal side only; upper cells small, papillose, basal cells elongate, smooth. Seta elongate; capsules usually erect; lid beaked; peristome teeth erect, divided nearly to base; calyptra cucullate.

Small plants, stems under 5 mm. high, leaves oblong-lanceolate, 1–1.5 mm. long
1. *D. Sprengelii*

Robust plants, stems 2 cm. high, leaves lingulate or spathulate, 2 mm. long
2. *D. spathulifolius*

1. DESMATODON SPRENGELII (Schwaegr.) Williams, Bull. Torr. Bot. Club **46**: 217. 1919.

Barbula Sprengelii Schwaegr., Suppl. 2[1]: 64. 1824.
Desmatodon Garberi Lesq. & James, Man. 112. 1884.
Hyophila fragilis Card., Rev. Bryol. **36**: 75. 1909.

Dioicous; small, densely tufted, green plants; stems 3–5 mm. high, radiculose below. Upper leaves 1–1.5 mm. long, crowded, incurved when dry, broadly lingulate, obtuse, often apiculate, entire or toothed near apex; margins strongly inflexed; costa strong, percurrent; upper cells small, dense, obscure, 5–8 μ, mammillose on upper face, basal cells oblong, smooth. Seta pale, to 5 mm. long; capsules erect, ovoid-cylindric, urn 1.5 mm. long; lid conic-rostrate; peristome teeth divided nearly to base, the forks strongly articulated, erect. (Fig. 62, A–D.)

Dept. Peten: *Bartlett 12541.* Dept. Chiquimula: *Steyermark 31743.*

Distribution: Florida, Mexico, British Honduras, West Indies.

Moist cliff at moderate altitude. These collections represent the wider leaved plants with entire apical margins previously referred to *D. Garberi.* I have followed Grout in reducing this form to *D. Sprengelii* but am not sure that they are conspecific.

2. DESMATODON (?) SPATHULIFOLIUS Bartr., Bryol. **50**: 205. 1947.

Rather robust, densely tufted plants, green above, pale brown below. Stems 2 cm. high, freely branched above from a stipe-like base. Leaves crowded, strongly contorted when dry, widely spreading when moist, to 2 mm. long, 0.6 mm. wide, lingulate from a narrowed base, widest about middle, carinate-concave, broadly rounded, mucronulate; margins entire or with a few blunt teeth near apex, narrowly involute in upper half; costa strong, brownish, percurrent, stereids lacking on ventral face; upper cells rounded, moderately incrassate, papillose, interior basal cells short rectangular, becoming quadrate toward margins. (Fig. 61, C–E.)

Dept. Huehuetenango: *Sharp 5245, 5247.*

Endemic.

On moist calcareous rocks at moderate altitudes. Suggestive of Hyophila in everything but the costal structure which shows a

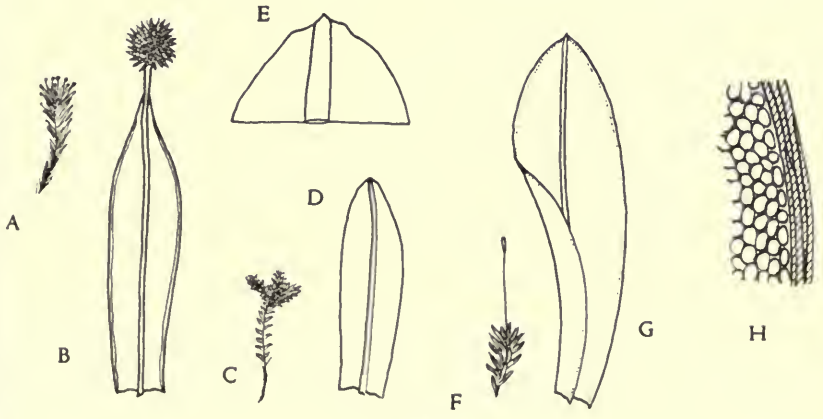

FIGURE 61

A–B, *Streptopogon rigidus:* A, plant, ×1; B, leaf, ×14.

C–E, *Desmatodon spathulifolius:* C, plant, ×1; D, leaf, ×14; E, apex of leaf, ×54.

F–H, *Tortula mniifolia:* F, plant, ×1; G, leaf, ×12; H, upper leaf cells and margin, ×110.

stereid band on the dorsal side only. I have tentatively referred the species to *Desmatodon* but its true affinity must wait upon the discovery of fruit. *Hyophila* (?) *lingulata* Card. has narrower leaves less broadly rounded at the apex and not mucronate.

24. ALOINELLA Card., Rev. Bryol. **36**: 76. 1909.

Small, brownish, gregarious, gemmiform plants; stems very short. Leaves fleshy, rigid, incurved when dry; margins broadly inflexed; costa broad, densely clothed on the ventral face with septate, chlorophyllose filaments; upper lamina cells incrassate, often broader than long, basal cells rectangular, thin walled, hyaline. Seta erect, elongate; capsules subcylindrical, peristome teeth divided to base into 32 papillose, erect forks; lid beaked; calyptra cucullate.

1. ALOINELLA HAMULUS (C. M.) Bartr., Bryol. **49**: 114. 1946.

Barbula hamulus C. M., Bull. Herb. Boiss. **5**: 192. 1897.

Dioicous; stems 1–2 mm. high. Upper leaves crowded, brown, 1.5 mm. long, oblong-lingulate from a pale, laxly areolate base, concave, strongly cucullate at apex; upper margins erose-denticulate, broadly inflexed with the edges often overlapping; costa clothed on the ventral face with filaments 2–3 cells high, excurrent in a short, blunt mucro; upper lamina cells mostly transversely elongate, to 20 μ long, 5–10 μ wide, incrassate, basal cells rectangular, thin walled, hyaline. Seta erect, reddish, 11 mm. long; capsule erect, ovoid-cylindric, urn brown, 2 mm. long; peristome teeth rather short, pale, from a low basal membrane, irregularly divided nearly to base, the forks papillose, erect, about 0.25 mm. long. (Fig. 62, E–H.)

Dept. Quezaltenango: *Bernoulli & Cario 118.*

Distribution: Mexico?

I feel reasonably sure that further collections from Guatemala will prove that this species and *A. catenula* Card. of Mexico are conspecific. One fruiting plant and some fragments of *Barbula hamulus* have been seen through the courtesy of the New York Botanical Garden. The seta is longer than mentioned by Cardot in his description of *A. catenula* but numerous subsequent collections of this species from Mexico show the setae varying from 6 to 14 mm. long so this character evidently has little diagnostic value.

25. TORTULA Hedw., Sp. Musc. 122. 1801. (in part).

Mostly medium sized to robust plants, often tinged with reddish brown; stems simple or branched. Leaves broad, ovate-lanceolate or spatulate, erect and twisted when dry; margins entire, usually revolute; costa strong, percurrent to long excurrent, with a thick dorsal stereid band and a ventral layer of large cells; upper leaf cells small, usually coarsely papillose, basal cells much larger, hyaline or colored, usually sharply differentiated.

1. Leaves with a narrow, thickened border of elongated cells.....3. *T. mniifolia*
   Leaves unbordered..... 2
2. Costa long excurrent.....4. *T. guatemalensis*
   Costa percurrent or short excurrent..... 3
3. Leaves fragile, abruptly mucronate, without propagula.....2. *T. fragilis*
   Leaves not fragile, costa percurrent, with propagula.....1. *T. caroliniana*

1. TORTULA CAROLINIANA Andrews, Bryol. **23**: 72. 1920.

Plants green or reddish brown, in small tufts, often associated with other mosses; stems to 1.5 cm. long. Leaves incurved when dry, to 4 mm. long, oblong-lanceolate, carinate, short apiculate, usually bearing numerous cylindrical, brownish septate propagula on the ventral face of the upper lamina; margins recurved more than half way up; costa brown, percurrent; upper cells rounded, 12–15 μ, papillose, often smaller and more incrassate in several rows toward margins, basal cells rectangular, smooth, thin walled.

Seta 7–8 mm. long, red; capsule cylindrical, to 3.5 mm. long, exothecial cells short rectangular with thickened, brownish walls, becoming smaller and rounded-hexagonal toward rim; annulus persistent, 50 μ wide, mostly of a single row of cells; peristome pale red, 0.6–0.7 mm. high, teeth slightly twisted, from a pale basal membrane projecting about 75 μ above rim of capsule and slightly higher than the annulus; lid conic-rostrate, 1 mm. long; spores pale brown, minutely papillose, diameter 12–15 μ. (Fig. 62, I–K.)

Dept. Alta Verapaz: *Standley 69556b.* Dept. Huehuetenango: *Steyermark 50599b; Sharp 4809* in fruit. Dept. Totonicapan: *Standley 84441a.* Dept. Quezaltenango: *Standley 83644a, 84193* in part. Dept. Sacatepequez: *Standley 58825a, 63711d.*

Distribution: North Carolina, Tennessee, Mexico, Costa Rica.

On trees and banks at medium to high altitudes. The Guatemalan plants are often more robust than those from the southern Appalachians but otherwise are typical. The percurrent costa and

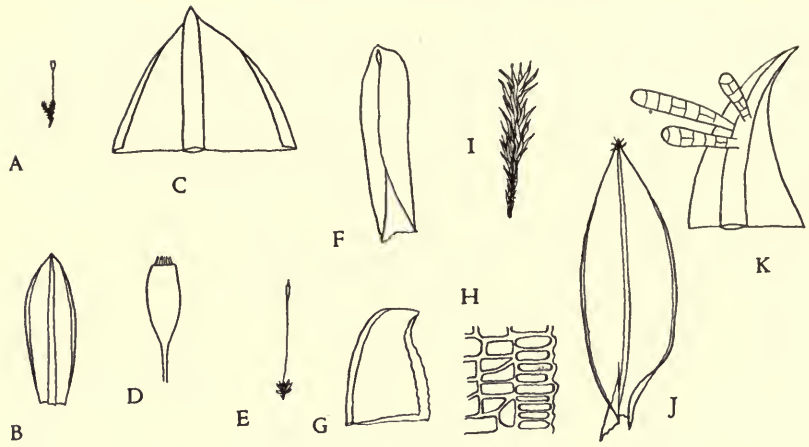

FIGURE 62

A–D, *Desmatodon Sprengelii:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, capsule, ×8.

E–H, *Aloinella hamulus:* E, plant, ×1; F, leaf, ×22; G, apex of leaf in profile, ×80; H, lamina cells, ×270.

I–K, *Tortula caroliniana:* I, plant, ×1; J, leaf, ×8; K, apex of leaf, ×54.

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the characteristic propagula on the upper leaf face are distinctive features.

2. TORTULA FRAGILIS Tayl., Lond. Journ. Bot. **6**: 333. 1847.

Tortula confusa Card., Rev. Bryol. **36**: 87. 1909.

Tortula Pringlei Card., Rev. Bryol. **36**: 87. 1909.

Moderately robust plants, usually reddish brown; stems from 3–4 mm. to 3–4 cm. high, matted with radicles below. Leaves conduplicate and incurved when dry, very brittle, to 3 mm. long, oblong-ovate, obtuse, mucronate; margins narrowly recurved below, often lobed in the smaller, rounded, comal leaves; costa short excurrent, brown; upper cells 10–15 μ, densely papillose, inner basal cells rectangular, thin walled, hyaline or colored, smaller and shorter toward margins. Seta 8–14 mm. long, red; capsule cylindric; peristome teeth from a distinct basal tube, spirally twisted. (Fig. 63, A–C.)

Dept. Quezaltenango: *Standley 66494a, 67682.* Dept. Sacatepequez: *Standley 58825* (as *T. parva*), *58832a* (as *T. parva*). Dept. Jutiapa: *Standley 75262.*

Distribution: Virginia, West Virginia, southwestern United States, Mexico, Colombia, Ecuador, Bolivia.

On trees and rocks at medium to high altitudes. The exceedingly brittle lamina and the abruptly short mucronate apex distinguish this species with little trouble. Some of the corticolous forms are very reduced in stature.

3. TORTULA MNIIFOLIA (Sull.) Mitt., Journ. Linn. Soc. **12**: 167. 1869.

Barbula mniifolia Sull., Proc. Am. Acad. 277. 1861.

Rather robust, brownish green, terrestrial plants in low, dense tufts. Stems 6–7 mm. high, densely foliate, sparsely radiculose. Leaves strongly curled and twisted when dry, spreading when moist, to 5 mm. long, 1.7 mm. wide, oblong-lingulate from a narrowed base, entire, obtuse, strongly bordered all around with a narrow, thickened band of brownish, elongate cells; costa rather slender, brown, merging with the border in the short, blunt point; upper cells hexagonal, thin-walled, smooth, diameter 25–28 μ, gradually becoming more lax and rectangular below. Seta red, 10–12 mm. long; capsule oblong-cylindric, urn 2.25 mm. long; peristome teeth from a short basal membrane. (Fig. 61, F–H.)

Dept. Baja Verapaz: *Sharp 2900.*

Distribution: Mexico, Costa Rica, West Indies, western South America to Bolivia.

On moist bank at moderate altitude. The plants are suggestive of *Atrichum* in a superficial way when dry and the brown bordered leaves bear some resemblance to those of *Mnium punctatum*. It is apparently uncommon and local in Central America.

4. TORTULA GUATEMALENSIS Bartr., Bryol. **49**: 114. 1946.

Robust reddish brown plants with the habit and appearance of *T. norvegica* (W. & M.). Stems to 5 cm. long, dichotomously branched. Leaves squarrose-recurved when moist, ovate-lanceolate, acute; margins plane throughout, often toothed at extreme apex; costa long excurrent in a reddish, sparingly spinose awn; upper leaf cells very opaque, densely papillose, 12–14 μ, basal cells rectangular, hyaline, shorter and narrower toward margins. Seta 8–10 mm. long; capsule narrowly cylindrical, urn 4 mm. long; peristome 1 mm. long, teeth slightly twisted from a short basal tube extending about 75 μ above the rim. (Fig. 63, D–G.)

Dept. San Marcos: Between San Sebastian and summit of Volcan Tajumulco, alt. 3,800–4,600 m., *Steyermark 33563a, 35564* TYPE. Dept. Totonicapan: *Standley 84521a.*

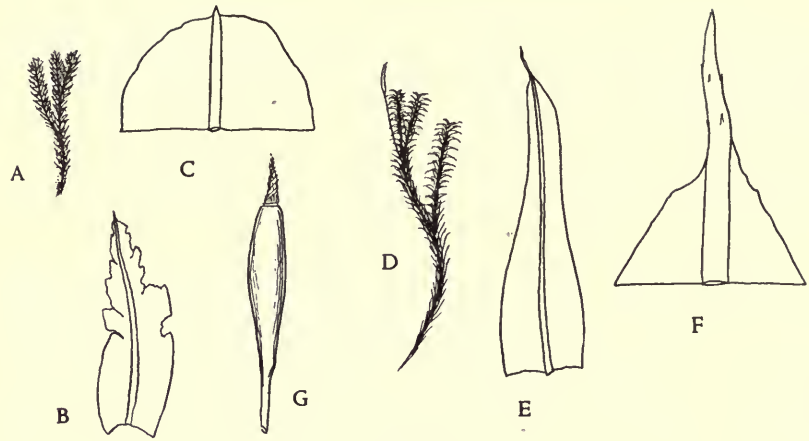

FIGURE 63

A–C, *Tortula fragilis:* A, plant, ×1; B, leaf, ×10; C, apex of leaf, ×26.
D–G, *Tortula guatemalensis:* D, plant, ×1; E, leaf, ×8; F, apex of leaf, ×54; G, capsule, ×6.

Endemic.

Very similar to *T. norvegica* in the acutely pointed leaves and the reddish awn but the plane margined leaves and short basal tube of the peristome leave no doubt that it is a distinct species.

11. GRIMMIACEAE

Small to medium sized plants, mostly rupestrine, growing in dense tufts or cushions. Leaves hygroscopic, often hyaline tipped; upper cells small, usually opaque, often in 2 or 3 layers, basal cells elongate, with straight or sinuous lateral walls; costa single, strong. Seta terminal, usually elongate; capsules ovoid or cylindrical; peristome single, teeth 16, entire or cleft above; calyptra mitriform or cucullate.

1. Calyptra plicate, leaves muticous.....3. *Ptychomitrium*
   Calyptra not plicate, leaves hyaline tipped..... 2
2. Leaf cells sinuose, short above.....1. *Grimmia*
   Leaf cells nodulose, narrowly linear.....2. *Rhacomitrium*

1. GRIMMIA Hedw., Sp. Musc. 73. 1801.

Densely tufted green plants; stems branched, radiculose below. Leaves crowded, usually hyaline pointed; upper cells small, in several layers especially toward margins, elongate and sinuose below. Seta

straight or curved; capsules ovoid, smooth or ribbed when dry; peristome teeth 2–3 cleft above; lid short, conical; calyptra mitriform.

1. Capsules immersed ..... 1. *G. apocarpa*
   Capsules exserted 2
2. Seta erect, straight ..... 2. *G. ovalis*
   Seta arcuate or flexuous ..... 3. *G. trichophylla*

1. GRIMMIA APOCARPA Hedw. var. GRACILIS (Schleich.) Web. & Mohr., Bot. Taschb. 131. 1807.

Grimmia gracilis Schleich., Catal. Helv. (Ed. 2) 29. 1807.

Plants very dark brown or blackish, glossy, forming low, dense mats. Stems to 2.5–3 cm. long, decumbent, densely foliate. Leaves erect, curved or slightly secund when dry, 1–1.5 mm. long, ovate, tipped with short, hyaline, denticulate hair-points; margins recurved, often sinuate-dentate toward apex; costa percurrent, slightly toothed on back near apex; basal cells short rectangular with firm, pale, sinuous lateral walls, becoming shorter and rounded above. Perichaetial leaves conspicuously larger, to 3 mm. long; capsule small, oblong, immersed; lid rostrate from a conical base; peristome teeth 0.5 mm. long, entire, red, lanceolate, filiform pointed, nodulose toward tips. (Fig. 64, A–C.)

Dept. Huehuetenango: *Sharp 5000.*

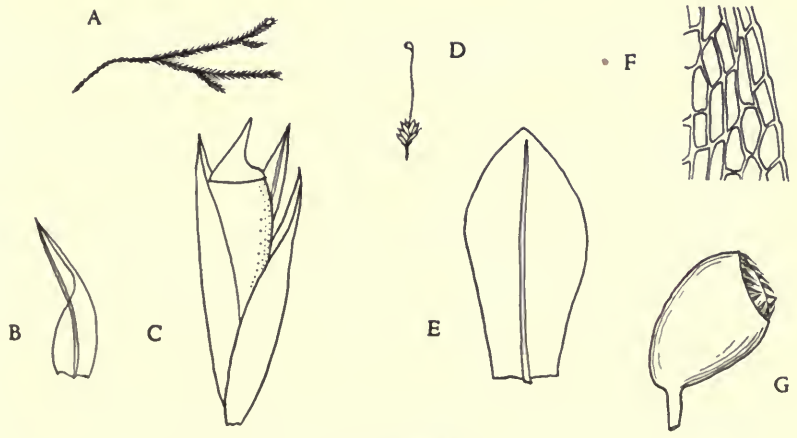

FIGURE 64

A–C, *Grimmia apocarpa* var. *gracilis:* A, plant, ×1; B, stem leaf, ×14; C, sporophyte, ×14.

D–G, *Funaria obtusata:* D, plant, ×1; E, leaf, ×14; F, upper leaf cells and margin, ×110; G, capsule, ×10.

Distribution: Northern United States and Canada south to West Virginia, Tennessee, Arizona.

On limestone boulder at high altitude. This is an unusual record, far to the south of the known range in North America. The plants are in perfect fruit and are typical in all respects excepting the peristome teeth which here instead of being cuneiform are narrowly lanceolate with long, filiform, nodulose tips. Although this is an anomalous feature I doubt if it has any real taxonomic value.

2. GRIMMIA OVALIS (Hedw.) Lindb., Acta Soc. Sci. Fenn. **10**: 75. 1871.

Dicranum ovale Hedw., Sp. Musc. 140. 1801.

?Grimmia brevi-exserta C. M., Bull. Herb. Boiss. **5**: 200. 1897.

?Grimmia Bernoullii C. M., Bull. Herb. Boiss. **5**: 200. 1897.

Grimmia praetermissa Card., Rev. Bryol. **36**: 105. 1909.

Plants densely tufted, green or yellowish at tips, brown below; stems branched, to 3 cm. high. Leaves 2.5–3 mm. long, imbricated when dry, lanceolate, hyaline tipped; margin recurved on one side below; costa ending below apex; upper cells rounded, sinuose, bistratose, elongated at base with straight or slightly sinuose lateral walls. Seta erect, 2–3 mm. long; capsule erect, exserted, ovoid; lid conical; peristome teeth 2–3 cleft to middle; calyptra mitriform. (Fig. 65, A–C.)

Dept. San Marcos: *Steyermark 35547a* (as *G. ovata*), *35548* (as *G. ovata*), *35549a* (as *G. ovata*). Dept. Quezaltenango: *Standley 65526a* (as *G. praetermissa*), *65530* (as *G. praetermissa*). Dept. Sacatepequez: *Standley 65262* (as *G. praetermissa*).

Distribution: Greenland, British Columbia to California and Arizona, Mexico, Europe, Asia.

On rocks and banks at high altitudes. The hyaline leaf tips vary from very short or none to quite long but in a broad sense I can see no advantage in separating these forms. The types of *G. brevi-exserta* and *G. Bernoullii* have not been seen but the descriptions strongly suggest that they belong here.

3. GRIMMIA TRICHOPHYLLA Grev., Fl. Edin. 235. 1824.

Yellowish green plants in lax tufts; stems to 3 cm. long. Leaves erect and twisted when dry, 2–2.5 mm. long, linear-lanceolate from an ovate base, hyaline tip subentire; margins recurved below; costa prominent at back; upper cells rounded, bistratose at margins, basal

cells linear, incrassate, slightly sinuose, shorter toward margins. Seta 3–5 mm. long, strongly curved; capsule ovoid, yellowish, ribbed with age; lid conic-rostrate; peristome teeth reddish, papillose, 2–3 cleft; calyptra mitriform. (Fig. 65, D–F.)

Dept. San Marcos: *Steyermark 35683* in part, *36091*, *36096a; Standley 85410*. Dept. Totonicapan: *Standley 84451*, *84462*, *84474*.

Distribution: Western North America, Hawaii, Europe, Asia, Africa, New Zealand.

On rocks at high altitudes. A widely distributed, variable species but usually easily recognized by the leaves with a distinctly thickened border and a long, nearly entire hyaline tip. As the plants fruit freely the curved setae are noteworthy.

2. RHACOMITRIUM Brid., Mant. 78. 1819.

Robust rupestrine plants in loose, extensive mats; stems often with numerous short lateral branchlets. Leaves lanceolate, usually hyaline tipped; costa ending in or near apex; leaf cells elongate, strongly sinuose or nodulose. Seta terminal, elongate; capsules erect, ovoid-cylindric; lid long beaked; peristome teeth deeply 2–3 cleft into narrow forks; calyptra mitriform.

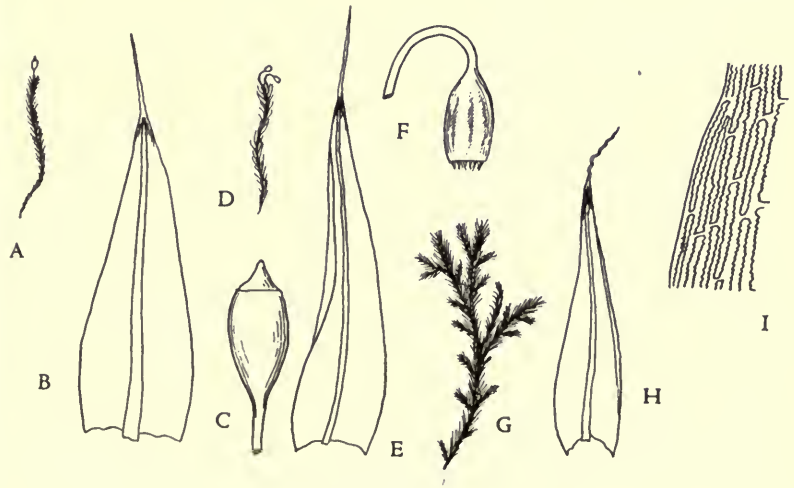

FIGURE 65

A–C, *Grimmia ovalis:* A, plant, ×1; B, leaf, ×22; C, capsule, ×8.
D–F, *Grimmia trichophylla:* D, plant, ×1; E, leaf, ×22; F, capsule, ×8.
G–I, *Rhacomitrium crispulum:* G, part of plant, ×1; H, leaf, ×14; I, upper leaf cells and margin, ×270.

1. RHACOMITRIUM CRISPULUM (H. f. & W.) H. f. & W., Fl. Tasm. 181. 1867.

Dryptodon crispulus H. f. & W., Fl. Ant. **1**: 57. 1843.
Trichostomum crispipilum Tayl., Lond. Journ. Bot. **5**: 47. 1846.
Grimmia contermina C. M., Syn. **2**: 655. 1851.
?Rhacomitrium fragile Ren. & Card., Rev. Bryol. **36**: 106. 1909.

Plants hoary, yellowish green above, brown below; stems decumbent, to 8 cm. or more long, with numerous short lateral branchlets. Leaves imbricated when dry, flexuous or secund, 3–3.5 mm. long, ovate-lanceolate, acuminate, carinate, hyaline tip very variable, from nearly obsolete to very long and strongly crisped; margin recurved on one side; costa prominent at back; cells linear with thickened, strongly nodulose lateral walls. Seta about 10 mm. long; capsule cylindric, urn about 3 mm. long, erect or slightly curved; lid subulate-rostrate. (Fig. 65, G–I.)

Dept. San Marcos: *Steyermark 35540, 36101, 36102.* Dept. Totonicapan: *Standley 84435a, 84445, 84449, 84461, 84546.* Dept. Quezaltenango: *Standley 67709, 67710a, 67711, 67714, 67715a, 67723;* Steyermark *34210, 34211, 34839.* Dept. Solola: *Steyermark 47447a, 47453, 47457.*

Distribution: Costa Rica to Fuegia, Africa, New Zealand, New Guinea, Java, Sumatra, Borneo, Hawaii.

On rocks and rocky banks at high altitudes. Apart from the hyaline tip, which is too variable to be used as a specific indicator, the Cordilleran plants ranging north to Guatemala differ in no essential way from those of other regions. It is evidently a plastic and widely distributed species.

3. PTYCHOMITRIUM Furnr., Flora **2**: 19. 1829.

Autoicous; medium sized tufted plants. Stems erect. Leaves crisped when dry, lanceolate, entire or toothed above; cells smooth, rounded above, narrower and elongate below. Setae erect, often aggregated; capsules ovoid; lid long beaked; peristome teeth 16, divided nearly to base into narrow, papillose, erect forks; calyptra mitriform, plicate, covering half the urn.

1. Leaves entire.....1. *P. Leibergii*
   Leaves sharply serrate above.....2
2. Capsule ovoid-cylindric.....2. *P. serratum*
   Capsule narrowly cylindrical.....3. *P. cylindrothecium*

1. PTYCHOMITRIUM LEIBERGII Best, Bryol. **9**: 80. 1906.

Plants 1–2 cm. high, brownish green, compactly tufted. Leaves crowded, crispate with incurved points when dry, 3–5 mm. long,

linear-lanceolate from an ovate base, broadly acute; margins plane, entire; costa strong, percurrent; upper cells rounded, 8–10 μ, obscure, often in 2 layers, basal cells oblong, hyaline. Seta 4–5 mm. long; capsule ovoid, urn 1–1.4 mm. long; peristome teeth brown, densely papillose, irregularly cleft; annulus broad; lid about 1 mm. long; calyptra plicate, lobed at base; spores 15–25 μ. (Fig. 66, A–D.)

Dept. Jalapa: *Standley 76792.*

Distribution: Arizona.

On dry, shaded banks at moderate altitude. These plants are more robust and the spores average larger than in the Arizona collections but these seem to be only trivial differences.

2. PTYCHOMITRIUM SERRATUM Bry. Eur. fasc. **2–3,** Mon. 4. 1837 (name only).

Brachysteleum serratum C. M., Syn. **1**: 768. 1849.

Glyphomitrium serratum Mitt., Journ. Linn. Soc. **12**: 106. 1869.

Robust, tufted plants, yellowish green above, brown below; stems erect, 3–4 cm. high. Leaves crowded, strongly crisped when dry, 5–6 mm. long, lanceolate, acuminate, apex acute, plicate near

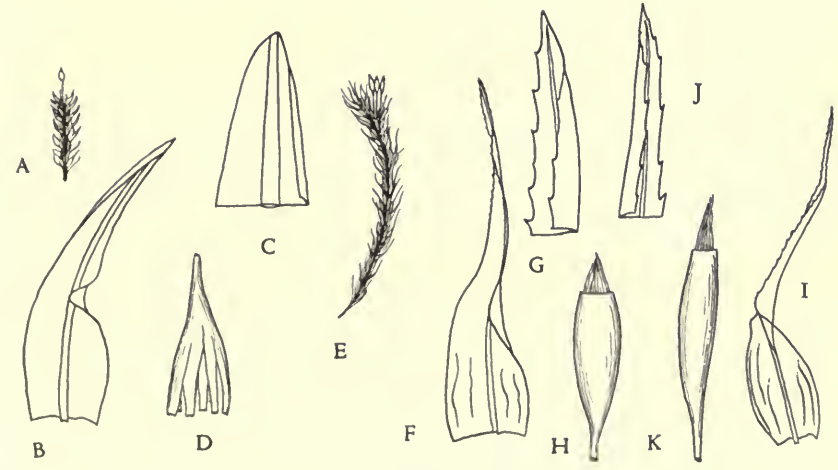

FIGURE 66

A–D, *Ptychomitrium Leibergii:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×120; D, calyptra, ×8.

E–H, *Ptychomitrium serratum:* E, plant, ×1; F, leaf, ×8; G, apex of leaf, ×54; H, capsule, ×8.

I–K, *Ptychomitrium cylindrothecium:* I, leaf, ×8; J, apex of leaf, ×54; K, capsule, ×8.

base; margins narrowly recurved below, coarsely serrate toward apex; costa percurrent; upper cells quadrate, incrassate, 8–10 μ, often in 2 layers near margins, basal cells linear, sinuose, hyaline. Setae 3–7 from one perichaetium, 3–5 mm. long; capsules ovoid-cylindric, urn 2.5 mm. long; lid 1 mm. long; peristome teeth bifid to near base, reddish; calyptra 2.5 mm. long, plicate, deeply lobed at base, serrate on the plaits above. (Fig. 66, E–H.)

Dept. Huehuetenango: *Standley 65943.*

Distribution: Western Texas, Mexico.

On damp bank at high altitude. A handsome plant and one that fruits freely throughout its range. The coarsely toothed leaves and clustered, short setae are conspicuous features.

3. PTYCHOMITRIUM CYLINDROTHECIUM (C. M.) Par., Ind. Bryol. 1056. 1897.

Brachysteleum cylindrothecium C. M., Bull. Herb. Boiss. 5: 199. 1897.

Plants similar to *P. serratum* but leaves more slenderly acuminate, usually strongly undulate in the upper half. Setae slender, clustered, about 5 mm. long, yellowish; capsules narrowly cylindrical, 2–2.5 mm. long; peristome teeth reddish, bifid, forks filiform, papillose; calyptra as in *P. serratum.* (Fig. 66, I–K.)

Dept. San Marcos: *Standley 85415.*

Endemic.

At high altitude. Although near *P. serratum* this species seems to be distinct in the more slenderly pointed leaves and the narrowly cylindrical capsules. Until a careful study of these and the closely allied species from Mexico and Colombia is made the group cannot be clearly resolved.

12. FUNARIACEAE

Small terrestrial plants with broad, soft, laxly areolate leaves crowded in a comal tuft. Costa slender, usually ending below apex; cells large, smooth, rhomboidal above, rectangular below. Seta terminal, erect; capsules erect or curved, smooth or ribbed; peristome single or double with segments opposite teeth or lacking; lid plano-convex; calyptra smooth, long beaked.

1. Capsules strongly curved and asymmetrical ..... 3. *Funaria*
   Capsules erect and symmetrical 2
2. Lid conical, calyptra mitriform ..... 1. *Physcomitrium*
   Lid nearly flat, calyptra cucullate, inflated ..... 2. *Entosthodon*

1. PHYSCOMITRIUM Brid., Bryol. Univ. **2**: 815. 1827.

Small, gregarious plants. Leaves contorted when dry, obovate or spatulate; costa subpercurrent. Seta slender, elongate; capsules erect, subglobose, wide mouthed, without peristome; lid planoconvex, apiculate; calyptra mitriform, long beaked, lobed at base; spores large.

1. PHYSCOMITRIUM OLLULA C. M., Bull. Herb. Boiss. **5**: 174. 1897.

Small plants; stems simple. Leaves few, crispate, undulate-concave when moist, rather broadly oblong from a long, very narrow base, folded together, short acuminate, acumen distinctly serrulate, recurved, narrowly bordered; costa reddish, slender, ending below apex; cells lax, pellucid. Seta short, red, erect; capsule "tumescenti-amphoroidea"; lid minute, flat, apiculate.

Alta Verapaz: Pansamala, alt. 3,800 ft., *H. v. Turckheim, Dec. 1887.*

The above is a free transcription of the original description. None of the original collection is available for comparison but I suspect *P. ollula* will prove to be identical with *P. subsphaericum* Schimp. of Mexico. The only noteworthy difference seems to be in the shortness of the setae which is a notoriously variable character in this group.

2. ENTOSTHODON Schwaegr., Suppl. **2**[1]: 44. 1823.

Small, autoicous plants with laxly areolate leaves. Seta slender, elongate; capsules erect, symmetrical; peristome single, often rudimentary, rarely lacking or double; lid convex, apiculate; calyptra long beaked, inflated below. Distinguished from Funaria only by the erect, symmetrical capsules.

1. Leaves obtuse, peristome well developed.....3. *E. longisetus*
   Leaves acuminate, peristome lacking or rudimentary.....2
2. Leaves obovate, bordered, serrulate.....1. *E. Bonplandii*
   Leaves lanceolate, not bordered, entire.....2. *E. acidotus*

1. ENTOSTHODON BONPLANDII (Brid.) Mitt., Journ. Linn. Soc. **12**: 245. 1869.

Gymnostomum Bonplandii Brid., Bryol. Univ. **1**: 101. 1826.

?Entosthodon microcarpus C. M., Bull. Herb. Boiss. **5**: 174. 1897.

Small, green, gregarious plants; stems 2 mm. high. Upper leaves few, crowded, 2 mm. long and a scant 1 mm. wide, obovate, concave,

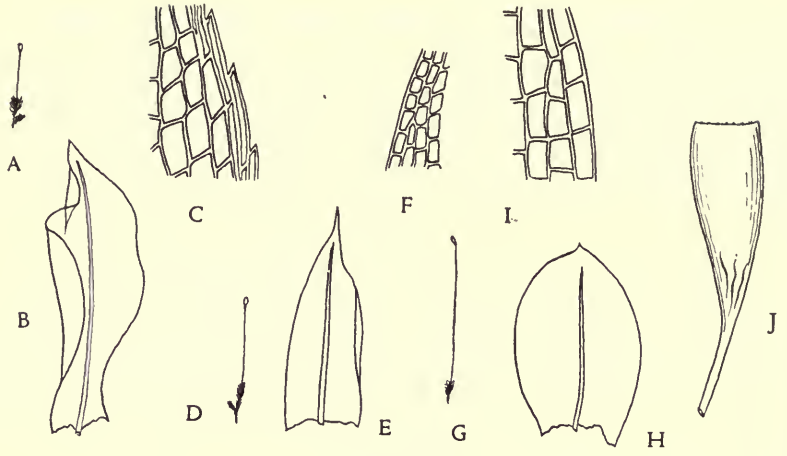

FIGURE 67

A–C, *Entosthodon Bonplandii:* A, plant, ×1; B, leaf, ×18; C, upper leaf cells and margin, ×120.

D–F, *Entosthodon acidotus:* D, plant, ×1; E, leaf, ×18; F, upper leaf cells and margin, ×120.

G–J, *Entosthodon longisetus:* G, plant, ×1; H, leaf, ×18; I, upper leaf cells and margin, ×120; J, capsule, ×14.

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short acuminate, bluntly denticulate in upper half; costa ending below apex; cells thin walled, oblong-hexagonal, about 25 μ x 65 μ, narrower in several rows at margins. Seta 6–10 mm. long, reddish; capsule erect, oblong-pyriform, urceolate and wide mouthed when dry; peristome teeth very rudimentary, short, hyaline and truncate or lacking. (Fig. 67, A–C.)

Dept. Alta Verapaz: *Standley 90014.*

Distribution: Costa Rica, West Indies.

On damp bank at moderate altitude. No original material of *E. Bonplandii* is available but the above collection corresponds in every way with the description and memoranda of Mrs. Britton's taken from the type. The description of *E. microcarpus* C. M. suggests nothing very different and it is probably the same thing.

2. ENTOSTHODON ACIDOTUS (Tayl.) C. M., Syn. **2**: 547. 1851.

Gymnostomum acidotum Tayl., Lond. Journ. Bot. **7**: 279. 1848.

Stems slender, 2–4 mm. high. Leaves erect, appressed, 1–1.5 mm. long, oblong-lanceolate, subulate-acuminate, entire; costa strong but thin, ending below apex; cells oblong with firm, yellowish pellucid

walls, laxer below. Seta slender, red, 5–10 mm. long; capsules erect or nodding, oblong-pyriform, tapering to a distinct neck, urn brown, 1–1.5 mm. long; peristome lacking. (Fig. 67, D–F.)

Dept. Chimaltenango: *Standley 61015* in part (as *Funaria microcarpa*).

Distribution: Ecuador, Bolivia.

On wet bank at high altitude. This is an interesting addition to the North American moss flora. The erect, imbricated, entire, unbordered leaves are sharply distinct from those of *E. Bonplandii* and seem to be similar in all ways to Spruce's No. 444 from Mt. Pichincha, Ecuador.

3. ENTOSTHODON LONGISETUS Schp., in Besch. Prodr. Bryol. Mex. 48. 1871.

Funaria epipedostegia Card., Rev. Bryol. **36**: 109. 1909.

Small, yellowish green plants, densely gregarious. Stems 4–5 mm. high. Upper leaves in a terminal tuft, decreasing in size below, to 2.8 mm. long, 1.2 mm. wide, spathulate-ovate from a narrow base, widest about middle, obtuse, minutely apiculate, unbordered, entire; costa ending below apex; upper cells irregularly hexagonal, thin-walled, 25–30 μ wide, gradually more elongate and rectangular below. Seta very variable in length, to 4 cm. long, slender, reddish; capsules suberect, pyriform, narrowed to a distinct neck; peristome simple, teeth red, well separated, linear-lanceolate. (Fig. 67, G–J.)

Dept. Alta Verapaz: *Sharp 2941*. Dept. El Quiche: *Sharp 2356*. Dept. Totonicapan: *Standley 84021*.

Distribution: Mexico.

On banks at moderately high altitudes. The broad, entire, unbordered leaves coupled with the peristomate capsules are good diagnostic characters.

3. FUNARIA Hedw., Sp. Musc. 172. 1801.

Autoicous; plants gregarious; stems short. Lower leaves small, the upper much larger and crowded in a terminal rosette, obovate, acuminate; cells lax; costa strong, ending in or near apex. Seta elongate; capsules pyriform with a long neck, usually unsymmetrical and arcuate, sulcate, mouth oblique; annulus large; lid nearly flat; peristome double, teeth 16, curved, segments opposite teeth.

Capsules smooth, annulus lacking ..... 1. *F. obtusata*
Capsules sulcate, annulus present ..... 2. *F. hygrometrica*

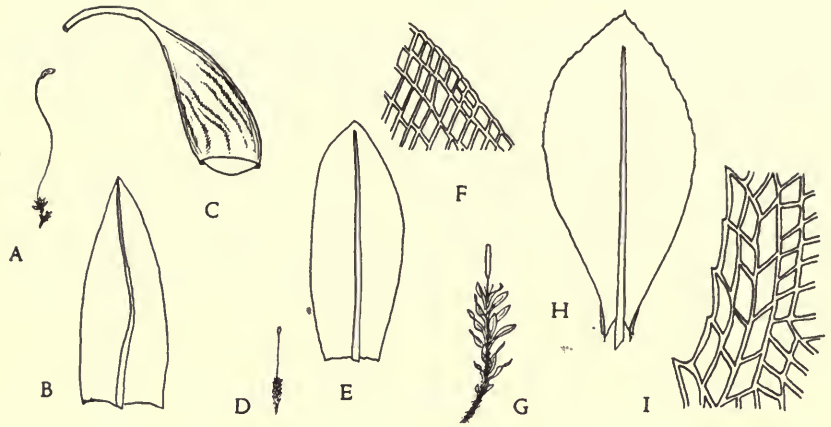

FIGURE 68

A–C, *Funaria hygrometrica:* A, plant, ×1; B, leaf, ×14; C, capsule, ×8.

D–F, *Splachnobryum Bernoullii:* D, plant, ×1; E, leaf, ×26; F, cells and margin near leaf apex, ×120.

G–I, *Tayloria mexicana:* G, plant, ×1; H, leaf, ×10; I, upper leaf cells and margin, ×54.

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1. FUNARIA OBTUSATA Schimp., in C. M. Syn. **2**: 540. 1851.

Small, densely tufted plants, dull yellowish green. Leaves crowded in a terminal tuft, to 2.5 mm. long, 1.2 mm. wide, lingulate, obtuse, entire or sinuate toward apex by the projecting marginal cells; costa slender, ending well below apex; upper cells irregularly hexagonal, 25–30 μ wide, elongate and rectangular toward base. Seta yellow, 1 cm. long; capsule strongly arcuate and asymmetrical when dry so that the mouth is vertical, faintly ribbed in lower half, nodding, pyriform when moist; peristome double; annulus lacking. (Fig. 64, D–G.)

Dept. Baja Verapaz: *Sharp 2794.*

Distribution: Mexico.

On soil at moderate altitude. Easily recognized by the short, curved asymmetrical capsules with the mouth nearly vertical. Previously known only from Mexico.

2. FUNARIA HYGROMETRICA Hedw., Sp. Musc. 172. 1801.

Funaria megapoda C. M., Bull. Herb. Boiss. **5**: 175. 1897.

Plants in extensive colonies, pale green; stems to 1 cm. high. Upper leaves contorted when dry, oblong-ovate, concave, short

acuminate, 2–4 mm. long, entire or weakly toothed; costa subpercurrent; upper cells hexagonal, elongated below. Seta 1–5 cm. long, flexuous; capsule pyriform, unsymmetrical, sulcate; peristome teeth spirally curved, dark red, united at tips, segments shorter than teeth; calyptra long beaked, inflated below. (Fig. 68, A–C.)

Dept. Alta Verapaz: *Standley 90790.* Dept. Huehuetenango: *Standley 65931, 82119, 81261, 82730.* Dept. San Marcos: *Standley 86265, 85340, 85373, 86436.* Dept. Totonicapan: *Standley 83989, 84475.* Dept. Quezaltenango: *Standley 66019, 66448, 83403.* Dept. Sacatepequez: *Standley 58031, 58642, 61175, 63052, 63707.* Dept. Chimaltenango: *Standley 61112, 80316, 80325.* Dept. Guatemala: *Standley 80504.* Dept. Zacapa: *Steyermark 42460.* Dept. Chiquimula: *Steyermark 31640.* Dept. Jalapa: *Steyermark 32680.* Dept. Santa Rosa: *Standley 77819.*

Distribution: Cosmopolitan.

On bare soil, burned ground, banks etc. Many of the above collections, especially from lower altitudes, represent the variety *calvescens* (Schwaegr.) Bry. Eur. but at high altitudes the typical form is not uncommon.

13. SPLACHNACEAE

Small to medium sized plants with erect stems and relatively broad leaves, laxly areolate as in *Funaria.* Costa ending below apex or excurrent. Seta elongate; capsules cylindrical, usually with a distinct hypophysis; peristome single, teeth 16, often in 8 pairs.

Leaves entire, apex rounded, not bordered.....1. *Splachnobryum*
Leaves serrate, apiculate, bordered.....2. *Tayloria*

1. SPLACHNOBRYUM C. M., Verh. z. b. Ges. Wien 503. 1869.

Dioicous; small, slender, gregarious plants. Leaves not crowded, lingulate, obtuse, subentire; costa weak, ending below apex; cells smooth and lax. Seta slender, elongate; capsule cylindric, erect; peristome teeth papillose, well spaced, irregularly cleft; lid conical; calyptra short, cucullate.

1. SPLACHNOBRYUM BERNOULLII C. M., Verh. z. b. Ges. Wien 505. 1869.

Splachnobryum crenulatulum Card., Rev. Bry. **36**: 86. 1909.

Plants green; stems 5–8 mm. high. Leaves oblong-ovate, 1–1.5 mm. long, rounded and crenulate at apex; margins recurved toward base; costa ending below apex; upper cells irregularly hexagonal, to

10–12 μ wide, smooth, more elongate below. Seta 4–5 mm. long, slender; capsule cylindric, urn 1 mm. long, pale yellow, reddish at mouth; peristome teeth 16, linear, coarsely papillose, deeply inserted; lid conical, 0.25 mm. long; spores 13–17 μ, smooth. (Fig. 68, D–F.)

Dept. Alta Verapaz: *Standley 70961* (as *S. obtusum* C. M.?). Dept. Zacapa: *Standley 73880* (as *S. obtusum?*).

Distribution: Mexico, Honduras.

On wet rocks and banks at low altitudes. Until the tropical American species of this genus are restudied it seems advisable to refer the local collections here. The Arizona collections referred to *S. Bernoullii* are apparently not the same thing and as far as I know *S. Bernoullii* has not been found north of Mexico. The sporophyte characters in the above description are from Standley's No. 53516 from Honduras.

2. TAYLORIA Hook., Journ. Sci. and Arts **3**: 144. 1816.

Medium sized plants; stems erect. Leaves not crowded, contorted when dry, lingulate or spatulate, entire or serrate, often bordered; cells lax; costa strong. Seta elongate; capsule erect with a tapering neck; peristome teeth 16, single or paired; lid conical; calyptra inflated below, smooth or pilose.

1. TAYLORIA MEXICANA (Thér.) Bartr., Bryol. **49**: 115. 1946.

Orthomnium mexicanum Thér., Rev. Bryol. et Lich. **5**: 103. 1932.

Moderately robust, pale green plants; stems about 1.5 cm. high, densely reddish tomentose below, laxly foliate. Leaves strongly contorted when dry, widely spreading when moist, 4 mm. long, 2 mm. wide, broadly spatulate, obtuse, short apiculate, narrowly bordered; margins recurved at extreme base, plane above, irregularly dentate with short teeth; costa ending below apex; leaf cells lax, oblong-hexagonal, gradually becoming rectangular below, 2–3 rows at margins broadly rectangular, hyaline, forming an indistinct border above middle. Seta short, smooth, 2–3 mm. long; capsule erect, narrowly cylindrical, to 4.5 mm. long; peristome teeth evenly spaced, brown, entire, to 300 μ long, minutely vertically papillose-striolate on the outer plates; spores brown, 15 μ. (Fig. 68, G–I.)

Dept. Quezaltenango: *Steyermark 34093a.* Dept. San Marcos: *Sharp 5477.* Dept. Chimaltenango: Slopes of Volcan de Acatenango above Las Calderas, alt. 2,400–2,700 m., in dense, wet, *Chiranthodendron* forest, *Standley 61932e.*

Distribution: Mexico.

This interesting and attractive species has some affinities with both *T. Jamesoni* (Tayl.) and *T. Moritziana* C. M. From the former it differs in the shorter setae, narrower capsule and narrower leaf border and from *T. Moritziana* in the short seta, evenly spaced peristome teeth and bordered leaves with short, blunt marginal teeth. Unfortunately the calyptrae are not available.

14. BRYACEAE

Small to very large plants, usually tufted. Stems radiculose below, simple or with subfloral innovations. Lower leaves small, the upper larger, lanceolate to obovate; costa strong, usually percurrent or excurrent; cells smooth, prosenchymatous, linear to rhomboidal, often narrower toward margins. Seta elongate; capsules mostly inclined to pendulous, usually tapering to a distinct neck; lid convex, apiculate; peristome normally double; calyptra cucullate; spores small.

1. Peristome teeth lacking ..... 1. *Mielichhoferia*
   Peristome teeth present 2
2. Inner peristome without basal membrane ..... 2. *Orthodontium*
   Inner peristome with basal membrane 3
3. Capsule suberect, segments of inner peristome none or rudimentary ..... 7. *Brachymenium*
   Capsule inclined or pendulous, segments well developed 4
4. Upper leaf cells narrow, linear or narrowly rhomboidal 5
   Upper leaf cells broad, rhomboidal 7
5. Stems julaceous, leaves closely imbricated ..... 8. *Anomobryum*
   Stems not julaceous, leaves spreading 6
6. Leaves narrow, costa broad ..... 3. *Leptobryum*
   Leaves broader, costa narrow ..... 4. *Pohlia*
7. Upper leaf cells lax, wide, 15 μ or more broad 8
   Upper leaf cells firm, less than 15 μ wide 9
8. Leaves dimorphous, lateral rows larger than the dorsal rows. 6. *Epipterygium*
   Leaves uniform ..... 5. *Mniobryum*
9. Segments of inner peristome split into widely divergent forks ..... 9. *Acidodontium*
   Segments not forked 10
10. Seta usually solitary, stems not stoloniferous ..... 10. *Bryum*
    Setae aggregated, stems stoloniferous ..... 11. *Rhodobryum*

1. MIELICHHOFERIA Hornsch., Bryol. Germ. 2^2: 179. 1831.

Slender, tufted plants. Leaves ovate-lanceolate, toothed above; costa strong, ending near apex; cells linear-rhomboidal. Seta slender;

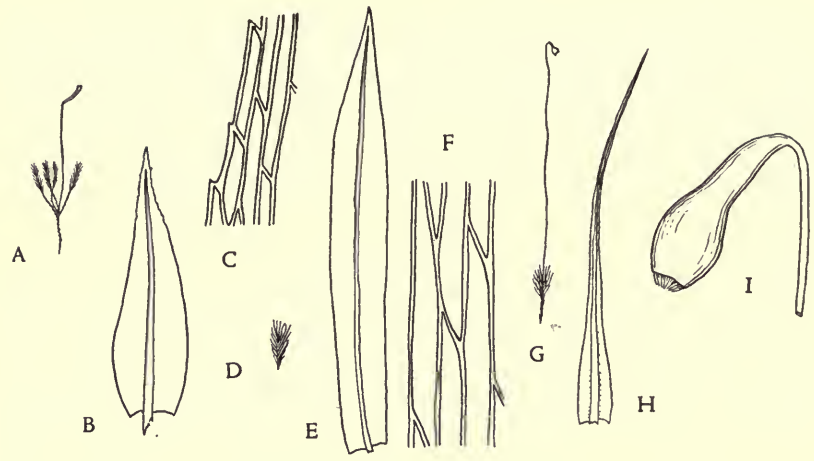

FIGURE 69

A–C, *Mielichhoferia praticola:* A, plant, ×1; B, leaf, ×26; C, upper leaf cells and margin, ×270.

D–F, *Orthodontium pellucens:* D, plant, ×1; E, leaf, ×20; F, upper leaf cells and margin, ×270.

G–I, *Leptobryum pyriforme:* G, plant, ×1; H, leaf, ×18; I, capsule, ×8.

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capsules pyriform, erect to horizontal; outer peristome lacking, segments of endostome linear from a short basal membrane; lid convex.

1. MIELICHHOFERIA PRATICOLA Card., Rev. Bryol. **38**: 3. 1911.

Synoicous; plants in close, fragile tufts, yellowish green above, brown below; stems 2–4 cm. high. Leaves suberect, 1.5 mm. long, narrowly lanceolate, acuminate; margins plane, denticulate toward apex; costa strong, ending below apex; cells linear-rhomboidal, with firm walls, shorter below. Seta about 15 mm. long; capsule cylindric, curved, erect or nodding, urn to 3 mm. long; segments of endostome filiform, smooth. (Fig. 69, A–C.)

Dept. San Marcos: *Steyermark 35544a, 35546.* Dept. Quezaltenango: *Steyermark 34194.*

Distribution: Mexico, Costa Rica.

Rock crevices at high altitudes. These collections appear to be identical with *M. praticola* but until a review of the tropical North American species is made the specific distinctions must remain uncertain.

2. ORTHODONTIUM Schwaegr., Suppl. 2^2: 123. 1827.

Small, delicate, yellowish green plants. Leaves numerous, long and narrow, subentire; costa nearly percurrent; cells linear-rhomboidal. Seta elongate; capsule cylindric, sulcate when dry; peristome double, teeth 16, slender, fragile, segments of endostome 16, not united below, about as long as teeth.

1. ORTHODONTIUM PELLUCENS (Hook.) Bry. Eur. fasc. **23–24.** 1844.

Bryum pellucens Hook., Ic. Pl. 1: 34. 1837.

Autoicous; plants densely tufted; stems 3–8 mm. high. Leaves flexuous when dry, linear-lanceolate, minutely denticulate near apex, about 3 mm. long; costa slender, ending just below apex; cells linear-rhomboidal, incrassate, shorter, laxer, thin walled and brownish at base. Seta slender, to 1 cm. long; capsule nodding, pyriform with a short neck, lightly sulcate when dry; peristome teeth and segments about equal in length. (Fig. 69, D–F.)

Dept. Quezaltenango: *Steyermark 34642.*

Distribution: California, Costa Rica, West Indies, South America.

On rocks near sulfur terraces at high altitude. This collection is sterile but is well within the known range of the species and evidently belongs here.

3. LEPTOBRYUM (Bry. Eur.) Schimp., Coroll. 64. 1855.

Bryum subg. *Leptobryum* Bry. Eur. fasc. **46–47.** 1851.

Slender, pale green, closely tufted plants. Leaves narrow, setaceous, costa broad; cells linear above, shorter and broader below. Seta elongate; capsule pyriform, glossy; peristome double, segments with median slits, cilia appendiculate.

1. LEPTOBRYUM PYRIFORME (Hedw.) Schimp., Coroll. 64. 1855.

Webera pyriformis Hedw., Sp. Musc. 169. 1801.

Synoicous; stems about 1 cm. high, laxly foliate. Leaves flexuous when dry, linear-setaceous, 2–3 mm. long; margins plane, denticulate above; costa broad below, excurrent; cells linear. Seta terminal, slender, to 3 cm. long; capsule pendulous, glossy, narrowed to a rather long, wrinkled neck; lid hemispherical; peristome complete, teeth

yellowish, segments of endostome from a high basal membrane; cilia 3, strongly appendiculate. (Fig. 69, G–I.)

Dept. San Marcos: *Standley 66232.*

Distribution: Wide and nearly cosmopolitan.

On damp bank at high altitude. Infrequent throughout Mexico and Central America and apparently confined to moderately high altitudes.

4. POHLIA Hedw., Sp. Musc. 171. 1801.

Plants tufted or associated with other mosses. Stems erect, simple or innovating. Leaves lanceolate, not distinctly bordered, denticulate above; costa usually ending below apex; cells narrow, usually linear, shorter and rectangular below. Seta elongate; capsules clavate or pyriform, inclined or pendulous; peristome double, segments of endostome with median slits; cilia nodose.

1. Capsule slender, with a long neck.....1. *P. spectabilis*
   Capsule clavate, with a short neck.....2
2. Leaves pale green with metallic luster.....2. *P. cruda*
   Leaves yellowish green, without luster.....3
3. Setae aggregated, short.....3. *P. polycarpa*
   Seta solitary, elongate.....4
4. Capsules suberect, endostome rudimentary.....6. *P. tenuiseta*
   Capsules nodding, endostome well developed.....5
5. Capsules ovoid, leaves short acuminate.....4. *P. papillosa*
   Capsules oblong-cylindric, leaves slenderly acuminate.....5. *P. peracuminata*

1. POHLIA SPECTABILIS (C. M.) Broth., E. & P. Pflanzenfam. 1³: 547. 1903.

Bryum spectabile C. M., Syn. 2: 583. 1851.

Webera cylindrica (Mont.) Schimp., in Besch., Prodr. Bryol. Mex. 52. 1871.

Paroicous; antheridia in axils of comal leaves. Plants slender, yellowish green; stems about 1 cm. high, nearly bare below. Comal leaves crowded, erect, 3–3.5 mm. long, lanceolate, acuminate; margins recurved below, denticulate toward apex; costa strong, ending just below apex or percurrent; cells linear, incrassate, shorter and rectangular at base. Seta slender, 2.5–3 cm. long; capsules nodding or horizontal, to 6–7 mm. long, cylindric, often curved, neck not much narrowed, shorter than the rest of the capsule; lid conical, apiculate; peristome teeth yellow, minutely papillose, segments of endostome narrow, nearly as long as teeth, scarcely slit, cilia 2–3, short and rudimentary, nodose; spores 12–15 μ. (Fig. 70, A–C.)

Dept. San Marcos: *Steyermark 35900a.* Dept. Totonicapan: *Standley 62712, 62697, 62699, 65909.* Dept. Quezaltenango: *Standley 67614a, 67680, 67686, 67690, 67694, 67695, 67716, 67755, 67759, 83404, 83407, 86115, 86121a; Steyermark 34136, 34165.*

Distribution: Mexico, Costa Rica, Colombia.

On damp banks, logs and trees at high altitudes. This frequent species fruits freely and will command attention at once by the relatively large and conspicuous, elongated capsules. When well developed the fruit is longer than in any of the nearly related species north of the Mexican border but the structural features are very similar.

2. POHLIA CRUDA (Hedw.) Lindb., Musc. Scand. 18. 1879.

Mnium crudum Hedw., Sp. Musc. 189. 1801.

Plants slender, loosely tufted, pale green with a pronounced metallic luster; stems to 4 cm. high, radiculose below. Lower leaves small and distant, above about 3 mm. long, ovate-lanceolate, short acuminate, denticulate toward apex; costa reddish below, ending below apex; upper cells linear, to 85 μ long, comal leaves often longer, narrower and slenderly acuminate. Seta 1.5–2 cm. long, reddish; capsule nodding or horizontal, oblong-cylindric, neck short; lid short, conical; peristome complete, teeth yellow, segments of endostome widely split, cilia 2–3, nodose. (Fig. 70, D–F.)

Dept. San Marcos: *Steyermark 35482, 36085.* Dept. Totonicapan: *Standley 62693, 62724, 84516a.* Dept. Quezaltenango: *Steyermark 34193a, 34251, 34254.*

Distribution: Wide in North America, south along Cordillera to Antarctica, Europe, Asia, Australia, New Zealand.

On rocks and trees at high altitudes. Several of these collections are more robust than the average but otherwise typical.

3. POHLIA POLYCARPA (Mitt.) Broth., E. & P. Pflanzenfam. **1**[3]: 548. 1903.

Bryum polycarpum Mitt., Journ. Linn. Soc. **12**: 293. 1869.

Webera Costesii Card. & Thér., Rev. Chil. Hist. Nat. **1917**: 13. 1917.

?Bryum aggregatum Hampe, Bull. Herb. Boiss. **5**: 181. 1897.

Dioicous? Small, dull green plants; stems slender, about 1 cm. high, nearly naked below. Upper leaves crowded in a comal tuft, 1.5–2 mm. long, ovate-lanceolate, acuminate, denticulate toward apex; costa ending below apex; margins plane or narrowly recurved below; cells linear, shorter and broader at base. Setae aggregated,

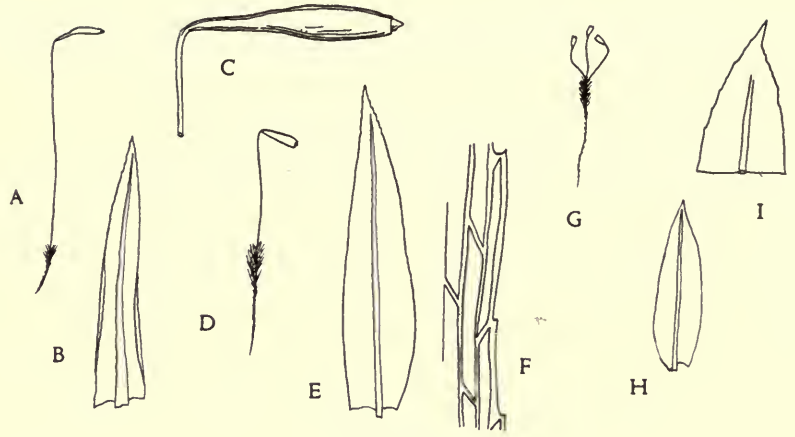

FIGURE 70

A–C, *Pohlia spectabilis:* A, plant, ×1; B, leaf, ×12; C, capsule, ×4.
D–F, *Pohlia cruda:* D, plant, ×1; E, leaf, ×14; F, upper leaf cells and margin, ×270.
G–I, *Pohlia polycarpa:* G, plant, ×1; H, leaf, ×14; I, apex of leaf, ×54.

2–4 from one perichaetium, 6–8 mm. long; capsules brown, oblong-cylindric, 2.5–3 mm. long, neck about equaling the rest of the capsule; peristome short, segments of endostome narrow from a short basal membrane, cilia none or very rudimentary; lid conical, apiculate. (Fig. 70, G–I.)

Volcan de Fuego, *Godman & Salvin.*

Distribution: Chile.

The clustered, short setae should readily identify this species which is known locally only from the type locality.

4. POHLIA PAPILLOSA (C. M.) Broth., E. & P. Pflanzenfam. 1^3: 552. 1903.

Bryum papillosum C. M., Syn. **1**: 326. 1849.
?Bryum didymodontium Mitt., Journ. Linn. Soc. **12**: 289. 1869.

Dioicous; plants slender, dull green; stems to 1.5 cm. high. Lower leaves minute and distant, the upper 1.5–2 mm. long, narrowly lanceolate, decurrent, acuminate, denticulate toward apex; margins plane or narrowly recurved below; costa strong, ending just below apex; cells linear. Seta slender, variable in length, from 3–8 cm. long; capsules nodding, ovoid, small mouthed, short necked, 2–3 mm. long, appearing papillose by the strongly convex exothecial

cells; lid convex, apiculate; peristome short, teeth densely but minutely papillose, segments of endostome narrow from a high basal membrane, about as long as teeth, cilia none or rudimentary. Sterile stems often with linear, vermicular propagula in the leaf axils. (Fig. 71, A–C.)

Dept. San Marcos: *Standley 66268, 66269, 86511a, 86515b; Steyermark 35631.* Dept. Quezaltenango: *Standley 66375, 83308, 83645, 85986, 86025.* Dept. Suchitepequez: *Steyermark 35324, 35362.*

Distribution: Mexico, Costa Rica, West Indies, northern South America.

On damp banks and trees at rather high altitudes. The long setae and short, small, wide mouthed capsules are very distinctive. Mitten's description of *Bryum didymodontium* is not very convincing as compared with Muller's species, and I strongly suspect they are conspecific.

Sterile plants may be distinguished from *Mniobryum Wahlenbergii* by the presence of gemmae in the upper leaf axils.

5. POHLIA PERACUMINATA Bartr., Bryol. **50**: 206. 1947.

Dioicous; tufts yellowish green and slightly glossy above, reddish tomentose below. Stems slender, laxly foliate, 1–1.5 cm. high.

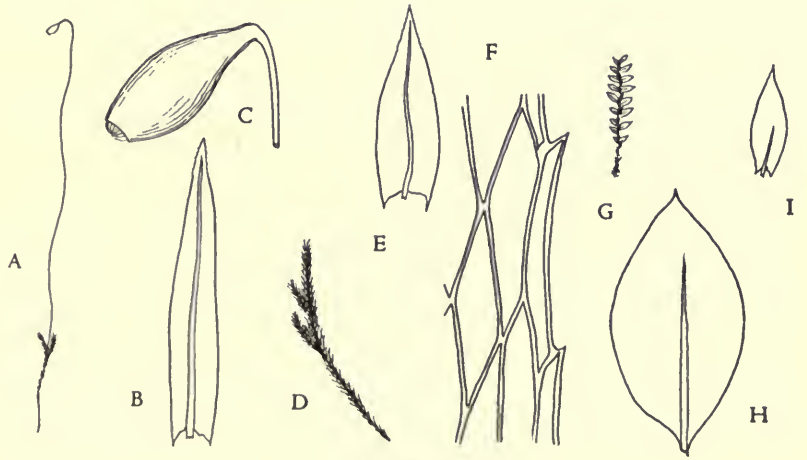

FIGURE 71

A–C, *Pohlia papillosa:* A, plant, ×1; B, leaf, ×14; C, capsule, ×8.

D–F, *Mniobryum Wahlenbergii:* D, plant, ×1; E, leaf, ×14; F, upper leaf cells and margin, ×270.

G–I, *Epipterygium immarginatum:* G, plant, ×1; H, lateral leaf, ×14; I, dorsal leaf, ×14.

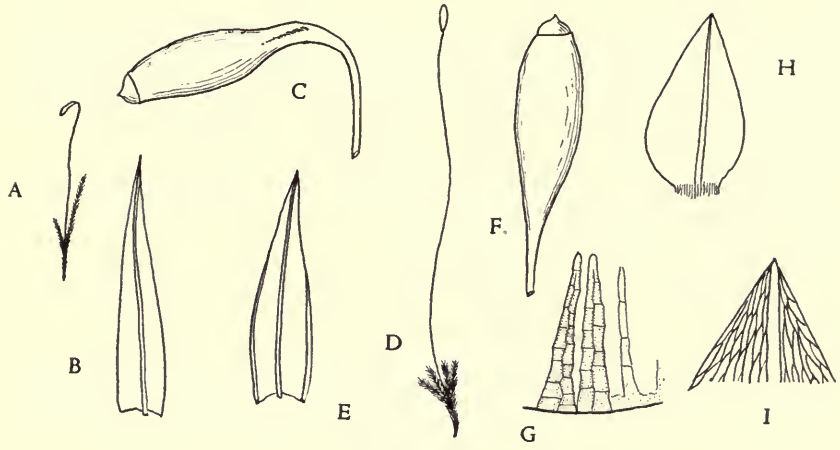

FIGURE 72

A–C, *Pohlia peracuminata:* A, plant, ×1; B, leaf, ×26; C, capsule, ×10.
D–G, *Pohlia tenuiseta:* D, plant, ×1; E, leaf, ×14; F, capsule, ×10; G, part of peristome, ×110.
H–I, *Anomobryum semiovatum:* H, leaf, ×14; I, apex of leaf, ×110.

Leaves erect-spreading, 1.5 mm. long, ovate-lanceolate, long and slenderly acuminate; margins recurved, minutely denticulate toward apex; costa ending in acumen; upper cells linear-rhomboidal, laxer and short rectangular toward base, not incrassate. Seta red, flexuous, to 2 cm. long; capsule pendulous, urn 3 mm. long with neck, oblong-cylindrical, neck about half the length of urn; lid conical; peristome teeth yellow, endostome from a high basal membrane, cilia 2, short, nodose. (Fig. 72, A–C.)

Dept. Huehuetenango: *Sharp 4780a.* Dept. San Marcos: *Sharp 5451a.*

Endemic.

On bank and tree trunk at high altitudes. *Bryum Seleri* C. M. is described as having the leaves "breviter acuminata" which should preclude any confusion with the new species. The dioicous inflorescence and sporophyte characters suggest faintly some affinity with *P. Drummondii* (C. M.) Andrews but the leaves of the Guatemalan plants are much more slenderly acuminate and the basal leaf cells lax and delicate.

6. POHLIA TENUISETA Bartr., Bryol. **50**: 206. 1947.

Dioicous; slender plants in dense, pale green tufts. Stems erect, 5–10 mm. high, radiculose at base. Upper leaves erect-spreading,

2–2.3 mm. long, narrowly ovate-lanceolate, acuminate; margins recurved below, minutely denticulate above; costa ending below apex; upper cells linear becoming short rectangular at base. Seta very slender, to 5 cm. long, flexuous, red; capsules suberect, oblong-cylindric from a short neck, small-mouthed, to 3.5 mm. long; lid convex, apiculate; peristome teeth yellow, about 0.2 mm. high, minutely papillose, endostome imperfect, consisting of a low, hyaline basal membrane with irregularly cleft segments about as long as teeth, cilia none or rudimentary; spores minutely papillose, diameter 20–25 μ. (Fig. 72, D–G.)

Dept. El Quiche: *Sharp 5336*. Dept. Huehuetenango: *Sharp 4909*.

Endemic.

On banks at moderate altitudes. This is an unusual species in several respects. The long, slender, bright red setae, suberect capsules and imperfect inner peristome are characters in the aggregate widely different from those attributed to any other member of the genus.

EXCLUDED SPECIES

Bryum Seleri C. M., Bull. Herb. Boiss. **5**: 181. 1897.

This species is evidently referable to *Pohlia* but it cannot be accurately determined from the description.

5. MNIOBRYUM (Schimp. ex p.) Limpr., Laubm. **2**: 272. 1892.

Mniobryum Schimp. in Bry. Eur. fasc. **46–47** et Consp. ad Vol. **4**. 1851.

Plants in lax pale green tufts; stems elongate, radiculose below, laxly foliate. Leaves slightly contorted when dry, ovate-lanceolate; costa ending below apex; cells lax, rhomboidal. Seta elongate; capsule ovoid, nodding or pendulous; peristome complete, cilia nodose; lid convex, apiculate.

1. Mniobryum Wahlenbergii (Web. & Mohr.) Bartr., *comb. nov.*

Hypnum Wahlenbergii Web. & Mohr., Bot. Taschenbuch 280. 1807.
Mnium albicans Wahlenb., Fl. Lapp. 353. 1812.

Dioicous; stems to 5 cm. long, often branched, slender. Leaves 1.5–2 mm. long, slightly decurrent, short acuminate; margins slightly recurved below; plane and denticulate above; costa reddish toward base, ending below apex; cells thin walled, to 15 or 20 μ wide and

100 μ long, narrower toward margins. Seta to 2 cm. or more long; capsule ovoid, wide mouthed, neck short; peristome teeth slender, yellowish, segments of endostome split, cilia 2 or 3, nodose. (Fig. 71, D–F.)

Dept. San Marcos: *Steyermark 36523*.

Distribution: Nearly cosmopolitan.

Wet banks and rocks at medium to high altitudes. No fertile plants have been seen from the local area. Sterile stems are frequently quite slender with reduced leaves.

6. EPIPTERYGIUM Lindb., Oefv. K. Vet.-Akad. Forh. **1863**: 599. 1863.

Dioicous; plants rather small, pale and dull green tinged with red; stems simple, radiculose below. Lower leaves small and distant, the upper not crowded, complanate, dimorphous, the lateral rows ovate, larger and broader than the dorsal rows; costa ending above mid-leaf; cells very lax and thin walled, narrower toward margins often forming a distinct, colored border. Seta elongate; capsule pendulous, small, ovoid; peristome complete, segments of endostome from a high basal membrane, cilia well developed, nodose.

Leaves with a reddish border.....2. *E. lepidopiloides*
Leaves not bordered.....1. *E. immarginatum*

1. EPIPTERYGIUM IMMARGINATUM Mitt., Journ. Linn. Soc. **12**: 319. 1869.

Densely gregarious, medium sized plants; stems about 2 cm. high. Lateral leaves broadly ovate, short apiculate, 2.5 mm. long; margins plane, minutely denticulate above; costa slender, ending well above mid-leaf; cells rhomboidal-hexagonal, to 20 μ x 120 μ, gradually narrower and longer toward margins but not forming a distinct border; dorsal leaves about 1 mm. long, lanceolate, acuminate. Seta 12–15 mm. long; capsule small, pendulous. (Fig. 71, G–I.)

Dept. Quezaltenango: *Steyermark 34736; Standley 65321*. Dept. Sacatepequez: *Standley 59446* in part.

Distribution: Costa Rica.

On wet banks and rocks at high altitudes. The longer costa and the indistinct, concolorous leaf border will aid in separating this species from the following.

2. EPIPTERYGIUM LEPIDOPILOIDES (C. M.) Par., Suppl. Ind. Bryol. 143. 1900.

Bryum lepidopiloides C. M., Bull. Herb. Boiss. **5**: 185. 1897.

Similar to *E. immarginatum* but smaller and more deeply tinged with red. Stems under 1 cm. high. Lateral leaves to 2.5 mm. long, oblong-ovate, short apiculate, entire; costa ending about mid-leaf or below; cells as in *E. immarginatum* but colored toward margins forming a rather indefinite reddish border; dorsal leaves much smaller, narrowly lanceolate, slenderly acuminate. Sporophyte not seen. (Fig. 73, A–D.)

Dept. Suchitepequez: *Steyermark 46850.*

Endemic.

On shaded cliff face at high altitude. Very distinct from *E. Wrightii* (Sull.) Lindb. of the West Indies in the oblong, not obovate, lateral leaves, less abruptly apiculate and the narrower, more elongated leaf cells.

7. BRACHYMENIUM Schwaegr., Suppl. **2**[1]: 131. 1824.

Small to medium sized plants, densely tufted. Leaves imbricated or contorted when dry; costa strong, often long excurrent; cells

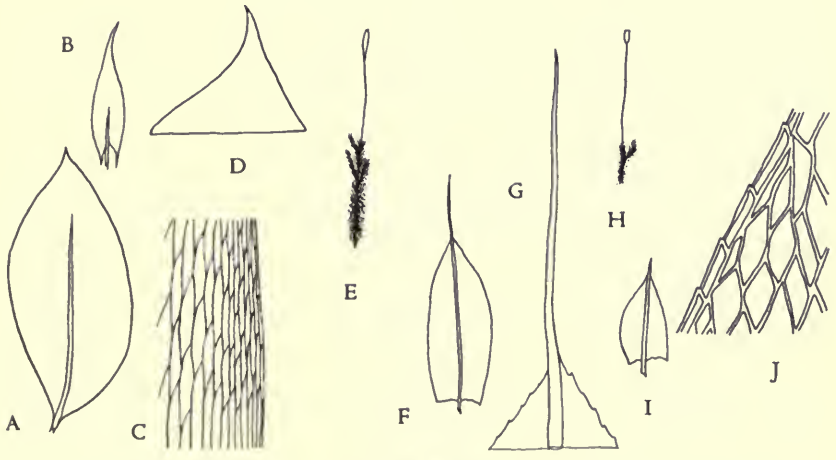

FIGURE 73

A–D, *Epipterygium lepidopiloides:* A, lateral leaf, ×14; B, dorsal leaf, ×14; C, upper leaf cells and margin, ×120; D, apex of leaf, ×54.

E–G, *Brachymenium systylium:* E, plant, ×1; F, leaf, ×14; G, apex of leaf, ×54.

H–J, *Brachymenium barbe-montis:* H, plant, ×1; I, leaf, ×14; J, upper leaf cells and margin, ×270.

rhomboidal above, short rectangular below. Seta elongate; capsule suberect; peristome double, teeth normally developed, endostome imperfect, consisting of an irregular basal membrane without segments or cilia.

1. Costa excurrent in a long, hyaline hair point.....1. *B. systylium*
   Costa not as above.....2
2. Leaves spirally twisted when dry, narrowly bordered.....4. *B. macrocarpum*
   Leaves erect-imbricated when dry, unbordered.....3
3. Small plants, leaves less than 1 mm. long, cells not incrassate
   2. *B. barbe-montis*
   Large plants, leaves 1–1.5 mm. long, cells very incrassate....3. *B. mexicanum*

1. BRACHYMENIUM SYSTYLIUM (C. M.) Jaeg., Adumb. **2**: 117. 1874–75.

Bryum systylium C. M., Syn. **1**: 320. 1849.
Bryum Carionis C. M., Bull. Herb. Boiss. **5**: 180. 1897.

Plants 1–3 cm. high, densely tufted, matted with reddish brown radicles below; stems branched. Leaves crowded, often in interrupted tufts, closely imbricated, unbordered, oblong-ovate, concave, with long, hyaline hair points; costa strong, excurrent in a long, subentire hair point; margins erect, denticulate above; cells rhomboidal-hexagonal becoming linear toward margins, quadrate toward base. Seta 1.5 mm. long or longer; capsule suberect, ovoid-cylindric, 3.5 mm. long; lid bluntly conical; peristome teeth slender, brown, papillose; endostome a low, yellowish membrane slightly exceeding the rim. (Fig. 73, E–G.)

Dept. Alta Verapaz: *Standley 69650, 71730, 71743a, 90775.* Dept. Huehuetenango: *Standley 81690, 82867; Steyermark 50598, 50599a.* Dept. Quezaltenango: *Standley 84261, 85738; Steyermark 34104, 34106.* Dept. Sacatepequez: *Standley 59011.* Dept. Solola: *Steyermark 46959.* Dept. Chimaltenango: *Standley 61856.* Dept. Jalapa: *Standley 75584.*

Distribution: Arizona, New Mexico, Mexico, Central and South America.

On trees, logs and damp, shaded banks at medium to high altitudes. Variable and frequent but easily recognized by the closely imbricated, hair-pointed leaves.

2. BRACHYMENIUM BARBE-MONTIS C. M., Bull. Soc. Roy. Bot. Belg. **31**: 165. 1892.

Small, densely tufted, terrestrial plants; stems to 7 mm. high, slender. Leaves erect and closely imbricated when dry, scarcely

1 mm. long, ovate, concave, aristate; margins erect, entire; costa strong, excurrent in a stout, concolorous arista; cells narrowly rhomboidal, not incrassate, narrower toward margins, short rectangular below. Seta slender, reddish, about 15 mm. long; capsule erect, ovoid with a short neck, wrinkled when dry, 1.5 mm. long; lid bluntly conical; peristome teeth linear, densely papillose, endostome a high membrane more than half the height of the teeth; annulus compound. Sterile stems frequently with small, foliose gemmae in upper leaf axils. (Fig. 73, H–J.)

Dept. Guatemala: *Standley 89438.* Dept. Jalapa: *Standley 76785, 77527.*

Distribution: Costa Rica.

On shaded banks at moderate altitudes. The small size and minute, unbordered leaves will distinguish this species without much trouble.

3. BRACHYMENIUM MEXICANUM Mont., Ann. Sci. Nat. Bot. Ser. II, **9**: 54. 1838.

Dull, yellowish green plants, closely tufted; stems to 1 cm. high, often branched. Lower leaves small, upper crowded in a comal tuft, closely imbricated, broadly ovate, about 1.5 mm. long, concave, cuspidate, entire, unbordered; costa excurrent in a short, concolorous point; upper cells rhomboidal-hexagonal, incrassate, basal cells quadrate. Seta 12–25 mm. long; capsule erect, ovoid-cylindric, tapering to a slender neck; lid bluntly conical; annulus broad; peristome teeth brownish, papillose, endostome about half the height of the teeth, irregularly laciniate on the edge. (Fig. 74, A–D.)

Dept. Huehuetenango: *Standley 82522a.* Dept. Quezaltenango: *Standley 83261a.* Dept. Jutiapa: *Standley 78443.*

Distribution: Texas, Mexico.

On banks and rocks mostly at rather high altitudes. The short pointed, unbordered leaves in compact comal tufts give this species a characteristic look.

4. BRACHYMENIUM MACROCARPUM Card., Rev. Bryol. **38**: 6. 1911.

Rather robust plants in green mats or tufts; stems about 1 cm. high, densely radiculose below, simple or branched. Leaves crowded, spirally twisted when dry, oblong-ovate, obtuse, cuspidate, to 2 mm. long, 1 mm. wide; margins strongly recurved, denticulate near apex; costa stout, excurrent in a toothed, concolorous point; upper cells

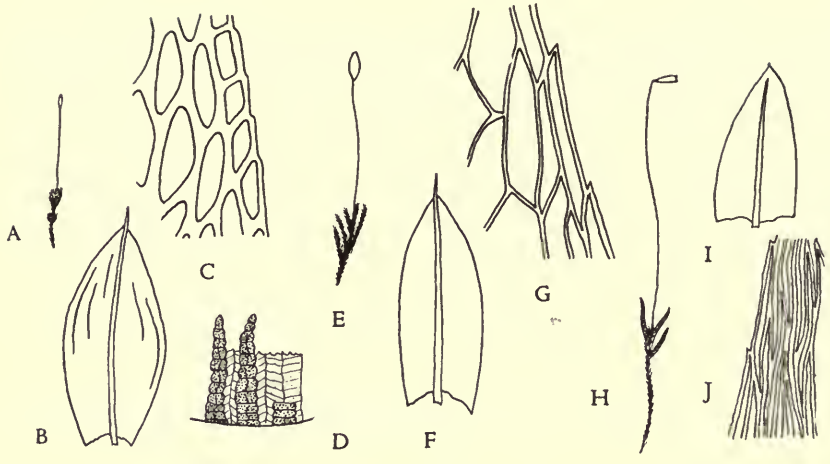

FIGURE 74

A–D, *Brachymenium mexicanum:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270; D, part of peristome, ×120.

E–G, *Brachymenium macrocarpum:* E, plant, ×1; F, leaf, ×14; G, upper leaf cells and margin, ×270.

H–J, *Anomobryum filiforme:* H, plant, ×1; I, leaf, ×14; J, upper leaf cells and margin, ×270.

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hexagonal, thin walled, densely chlorophyllose, elongate in 1 or 2 rows at margins forming a narrow border, basal cells quadrate. Seta red, 1.5–2 cm. long; capsule erect, ovoid-cylindric, small mouthed, 3–4 mm. long; lid conical, curved, a scant 1 mm. long; peristome teeth brown, densely papillose, endostome a high yellowish, papillose cylinder, laciniate on the edge. (Fig. 74, E–G.)

Dept. Peten: *Lundell 2056.*

Distribution: Florida, Mexico.

On rocks, logs and trees at low altitude. Sharply distinct from the other local species in that the leaves are spirally twisted when dry with the margins recurved nearly to apex.

8. ANOMOBRYUM Schimp., Syn. Ed. I, 382. 1860.

Dioicous; slender, pale green, glossy plants; stems evenly foliate and terete. Leaves erect, closely imbricated, ovate, concave, entire; costa ending below apex; upper cells narrow, more lax and rhomboidal below. Seta elongate; capsule pendulous; peristome double and complete.

1. Leaves plicate, upper cells to 50 μ long.....2. *A. plicatum*
   Leaves not plicate, upper cells to 100 μ long.....2
2. Leaves bluntly pointed, costa ending below apex.....1. *A. filiforme*
   Leaves acute, costa percurrent.....3. *A. semiovatum*

1. ANOMOBRYUM FILIFORME (Dicks) Husn., Musc. Gall. 222. 1888.

Bryum filiforme Dicks., Pl. Crypt. fasc. **4**: 16. 1801.

?Bryum perappresum C. M., Bull. Herb. Boiss. **5**: 182. 1897.

Plants tufted, to 2 cm. or more high, glossy; stems julaceous, with subfloral innovations. Leaves numerous, erect and rigidly imbricated, 1–1.5 mm. long, obtuse to broadly acute; margins erect, denticulate toward apex; costa ending below apex; upper cells linear, to 100 μ or more long, incrassate, vermicular, broader, shorter and thin walled below. Seta slender, flexuous, to 2 cm. long; capsule oblong-cylindric, neck distinct, 3–4 mm. long; peristome teeth yellow, segments of endostome from a high basal membrane, split, cilia appendiculate. (Fig. 74, H–J.)

Dept. Huehuetenango: *Standley 82428*. Dept. San Marcos: *Standley 66271; Steyermark 35675, 35993*. Dept. Totonicapan: *Standley 65921, 84425*. Dept. Quezaltenango: *Standley 67829, 67861, 83313, 83430, 83377, 85245, 85987, 86045; Steyermark 33929, 34596, 34618, 34916, 34920*. Dept. Sacatepequez: *Standley 65273*. Dept. Chimaltenango: *Standley 62322, 64480*.

Distribution: Greenland to Alaska south to New York, Wisconsin and Minnesota, Mexico, Costa Rica, South America, Europe, Africa.

On damp banks and rocks at medium to high altitudes. The species is quite variable and I cannot satisfactorily segregate the var. *mexicanum* (Schimp.) Par. from the type concept. It fruits freely in Mexico and Costa Rica and is apparently broadly distributed.

2. ANOMOBRYUM PLICATUM Card., Rev. Bryol. **36**: 112. 1909.

More robust than *A. filiforme;* stems to 5 cm. or more high. Leaves broadly ovate, about as broad as long, rounded at apex, crenulate-denticulate about half way down, often with 1 or 2 noticeable plicae on either side of costa; costa stout, ending below apex; upper cells narrowly rhomboidal, 8–10 μ wide, 25–50 μ long, incrassate, much narrower and linear in several rows toward margins, basal cells shorter and broader. (Fig. 75, A–C.)

Dept. Huehuetenango: *Standley 81087, 81179* in part.

Distribution: Mexico.

Alpine meadow. Distinct from *A. filiforme* in the orbicular-ovate leaves and shorter, broader upper leaf cells.

3. ANOMOBRYUM SEMIOVATUM (Brid.) Jaeg., Adumb. **1**: 602. 1874–75.

Bryum semiovatum Brid., Bryol. Univ. **1**: 846. 1826.

Slender yellowish green plants forming low, dense mats. Stems decumbent, to 2 cm. long, julaceous when moist. Leaves laxly appressed when dry, tightly imbricated when moist, to 1.5 mm. long, ovate, concave, acute; margins erect, entire; costa percurrent; upper cells rather lax, linear-rhomboidal, 12–15 μ wide, 60–100 μ long, laxer toward base. Fruit not seen. (Fig. 72, H–I.)

Dept. Solola: *Svihla 2890b.*

Distribution: Costa Rica, Ecuador, Peru.

At moderate altitudes. Unless I am much mistaken this collection represents a robust form of this species. It is well distinguished from *A. filiforme* by the laxer upper leaf cells, percurrent costa and acute leaf points. Furthermore the leaf points when dry are spreading, not closely appressed, so that the stems lack the characteristic julaceous appearance of *A. filiforme.*

9. ACIDODONTIUM Schwaegr., Suppl. 2^2: 152. 1827.

Dioicous; plants medium sized growing in dense, green tufts matted together with reddish brown radicles below; stems with numerous subfloral innovations. Leaves lanceolate, piliform acuminate, bordered; margins recurved below; costa ending below apex or excurrent; cells hexagonal above, rectangular below. Seta elongate; capsule large, suberect or nodding, ovoid, long necked; peristome double, teeth papillose, segments of endostome split into 2 divergent forks, cilia rudimentary; lid conical, short.

1. ACIDODONTIUM MEGALOCARPUM (Hook.) Ren. & Card., Bull. Soc. Bot. Belg. **31**: 162. 1892.

Bryum megalocarpum Hook. in Kunth., Syn. Pl. Aeq. **59**: 1822–28.

Acidodontium floresianum C. M., Bull. Soc. Bot. Belg. **31**: 162. 1892.

Stems about 2 cm. high. Leaves numerous, spirally contorted when dry, 3 mm. long, ovate-lanceolate, narrowed to a slender, toothed, hair-like point; margins narrowly recurved near base, plane above, denticulate toward apex; costa slender, ending near base of

acumen; upper cells hexagonal, thin walled, 1–2 rows at margins narrowly linear, not forming a distinct border, basal cells laxly rectangular. Seta 2.5–3.5 cm. long; capsule ovoid-cylindric, abruptly contracted to a slender, rugose neck, small mouthed; peristome teeth broad below, abruptly contracted to a long subulate point, segments of endostome from a high basal membrane, forks widely divergent. (Fig. 75, D–G.)

Dept. Alta Verapaz: *Standley 90878.*

Distribution: Costa Rica, Ecuador, Colombia.

On trees at moderate altitude. Allowing for a reasonable variation in leaf outline there seems to be no appreciable difference between *A. floresianum* and *A. megalocarpum.* The conspicuous capsules and the curiously forked segments are distinctive characters.

10. BRYUM Hedw., Sp. Musc. 178. 1801 in part.

Small to very large, tufted plants; stems with subfloral innovations, radiculose below. Leaves usually ovate-lanceolate, often bordered with narrower cells, entire or nearly so; costa excurrent or ending in or near apex; upper cells rhomboidal. Seta terminal, elongate; capsules clavate or pyriform, mostly horizontal or pen-

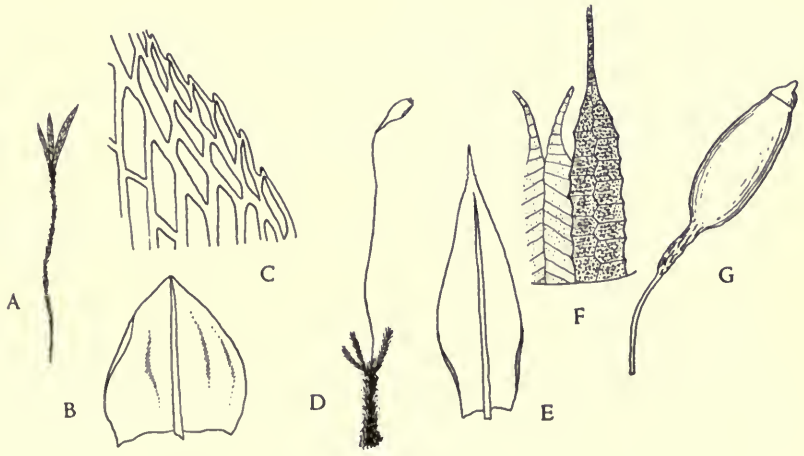

FIGURE 75

A–C, *Anomobryum plicatum:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270.

D–G, *Acidodontium megalocarpum:* D, plant, ×1; E, leaf, ×14; F, part of peristome, ×54; G, capsule, ×4.

dulous; peristome double, usually complete, teeth 16, lanceolate, endostome with a high basal membrane bearing 16 keeled, split segments and appendiculate cilia; lid convex, apiculate; calyptra small, fugacious.

1. Leaves silvery white or yellow....2
   Plants green, often with a reddish or brownish tinge....3
2. Plants silvery white, capsule oblong with a short neck....3. *B. argenteum*
   Plants yellow, capsule narrowly cylindrical, with a long neck.4. *B. chryseum*
3. Capsule short, with a thick, spongy neck, abruptly contracted to seta....4
   Capsule elongate, with a slender, tapering neck....5
4. Capsule cylindrical, 2 mm. or more long, leaves 2–3 mm. long
   5. *B. coronatum*
   Capsule subglobose, 1 mm. or less long, leaves about 1.5 mm. long
   6. *B. microbalanum*
5. Leaves bluntly pointed....6
   Leaves acuminate....7
6. Leaves not bordered, ovate-lanceolate....1. *B. Crugeri*
   Leaves strongly bordered, orbicular-oval....2. *B. mnioides*
7. Very robust plants, stems to 12 or 15 cm. long, leaves long decurrent
   13. *B. procerum*
   Stems shorter, seldom over 3–4 cm. long, leaves scarcely decurrent....8
8. Leaf cells lax, thin-walled....8. *B. capillare*
   Leaf cells firm, thick-walled....9
9. Costa long excurrent, synoicous....9. *B. cuspidatum*
   Costa short excurrent, dioicous....10
10. Stems evenly foliate, leaves contorted and appressed when dry
    7. *B. pseudotriquetrum*
    Stems with the leaves imbricated, crowded above, often in rosulate tufts...11
11. Upper leaves in conspicuous rosulate tufts, leaf cells elongate.10. *B. truncorum*
    Upper leaves crowded but not in rosulate tufts, leaf cells short, 1:2 or less..12
12. Leaf margins with short, single teeth....11. *B. Mangini*
    Leaf margins spinose-serrate, teeth often in pairs....12. *B. geminidens*

1. BRYUM CRUGERI Hampe, in C. M., Syn. **1**: 300. 1849.

Dioicous; rather small, pale green, slightly glossy plants, densely tufted; stems red, branched. Lower leaves widely spreading, upper more erect, 1.5–2 mm. long, oblong-ovate, concave, bluntly acute; margins plane, subentire; costa slender, percurrent; cells narrowly rhomboidal, linear near margins, lax and broad near base. Seta 1.5–2 cm. long, slender; capsule pendulous, clavate with a tapering neck; peristome teeth dark brown, segments widely perforate along keel, cilia appendiculate. (Fig. 76, A–C.)

Dept. Izabal: *Standley 72462*. Dept. Zacapa: *Steyermark 29389*. Dept. Chiquimula: *Steyermark 30878*.

Distribution: Florida, Costa Rica, West Indies, South America.

On damp ground at low altitudes. The deeply concave, short pointed unbordered leaves will readily distinguish this species.

2. BRYUM MNIOIDES (Schimp.) Broth., E. & P. Pflanzenfam. 1^3: 574. 1904.

Webera mnioides Schimp., Ann. Sci. Nat. 6, Ser. 3: 204. 1876.

Fragile, brownish green plants in dense tufts or cushions. Stems to 2 cm. high, laxly foliate, with clusters of brownish, septate filaments in the upper leaf axils. Leaves contorted when dry, widely spreading when moist, orbicular-oval, slightly concave, decurrent, obtuse or broadly rounded, bordered, subentire to faintly sinuate, 1.5–1.8 mm. long, 1.2 mm. wide; margins erect; costa strong, brown, ending below apex; upper cells short hexagonal, 3–5 rows at margins linear with brown, incrassate walls, forming a strong border, basal cells rectangular. Fruit not seen. (Fig. 78, A–C.)

Dept. El Quiche: *Sharp 2454*. Dept. Baja Verapaz: *Sharp 2814, 2818*.

Distribution: Guadeloupe.

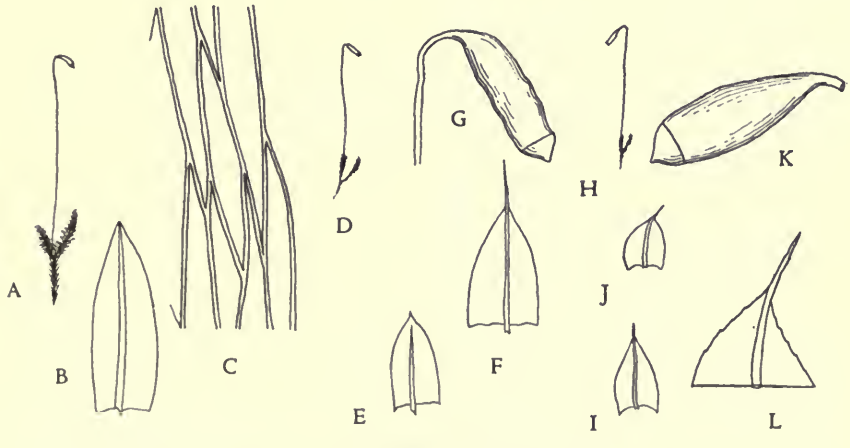

FIGURE 76

A–C, *Bryum Crugeri:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270.

D–G, *Bryum argenteum:* D, plant, ×1; E, leaf, ×14; F, leaf of var. *lanatum*, ×14; G, capsule, ×8.

H–L, *Bryum chryseum:* H, plant, ×1; I and J, leaves, ×14; K, capsule, ×8; L, apex of leaf, ×54.

On moist rocks at moderate altitudes. As these collections are sterile the determination is questionable but the broadly ovate leaves with the costa ending below the short, blunt apex, compare favorably with the original description and with specimens from Guadeloupe.

3. BRYUM ARGENTEUM Hedw., Sp. Musc. 181. 1801.

?Bryum subcorrugatum C. M., Bull. Herb. Boiss. **5**: 182. 1897.
?Bryum lagunicolum C. M., Bull. Herb. Boiss. **5**: 183. 1897.

Dioicous; small, silvery white, often densely tufted plants; stems red, fragile. Leaves crowded, imbricated, broadly ovate, acuminate, entire; costa ending below apex or excurrent in forms; upper cells hyaline, narrow, basal cells quadrate, chlorophyllose. Seta slender, red, about 1 cm. high; capsule pendulous, oblong, short necked; peristome complete. (Fig. 76, D–G.)

Dept. Alta Verapaz: *Standley 71743*. Dept. Huehuetenango: *Steyermark 48928; Standley 81111, 81714, 81721*. Dept. Totonicapan: *Standley 83156, 84447*. Dept. Quezaltenango: *Standley 66497, 83400, 83459, 84155; Steyermark 34625a, 34626, 34835*. Dept. Sacatepequez: *Standley 58644, 58646*. Dept. Guatemala: *Standley 80716*. Dept. Chiquimula: *Steyermark 30611*. Dept. Jutiapa: *Standley 75711, 78450*. Dept. Jalapa: *Standley 76713, 77499*. Dept. Santa Rosa: *Standley 78248*.

Distribution: Cosmopolitan.

On banks, rocks, trees, etc., at medium to high altitudes. A cosmopolitan species with an extensive synonymy. Many of the above collections represent the var. *lanatum* (P. B.) Bry. Eur. with the costa excurrent but there are closely intergrading forms.

4. BRYUM CHRYSEUM Mitt., Journ. Linn. Soc. **12**: 304. 1869.

?Bryum guatemalense Hampe, Bull. Herb. Boiss. **5**: 182. 1897.

Dioicous; plants small, yellowish, slightly glossy, densely tufted; stems to 5–6 mm. high, julaceous. Leaves closely imbricated with spreading points, about 1 mm. long, broadly ovate, concave, slenderly acuminate, minutely denticulate toward apex; costa excurrent in a concolorous, denticulate point; upper cells linear-rhomboidal, basal cells quadrate, chlorophyllose. Seta to 20 mm. long; capsule horizontal, cylindrical with a tapering neck; peristome complete. (Fig. 76, H–L.)

Dept. Quezaltenango: *Standley 84815*.

Distribution: Mexico.

On dry bank at rather high altitude. The yellowish, terete stems with the leaf points widely spreading on all sides and the narrow capsule with a tapering neck clearly distinguish this species from any form of *B. argenteum*.

5. BRYUM CORONATUM Schwaegr., Suppl. **1**[2]: 103. 1816.

Dioicous; plants green, tufted, radiculose below; stems short, slender, rarely over 1 cm. high. Leaves numerous, erect and slightly contorted when dry, to 2–3.5 mm. long, ovate-lanceolate, acuminate, concave, entire; costa usually excurrent; cells narrowly rhomboidal, narrower toward margins but not forming a distinct border, broader and shorter below. Seta slender, red, to 2 cm. or more long; capsule red, pendulous, oblong, 2–2.5 mm. long, with a short, spongy, rounded neck; peristome complete. (Fig. 77, A–C.)

Dept. Jutiapa: *Standley 76102*.

Distribution: Pantropical, north to Florida.

On damp banks, rocks, etc., mostly at low altitudes. Readily known by the peculiar short necked capsules.

6. BRYUM MICROBALANUM Card., Rev. Bryol. **36**: 112. 1909.

Similar to *B. coronatum* but smaller. Plants yellowish; stems less than 5 mm. high. Leaves erect, imbricated when dry, about

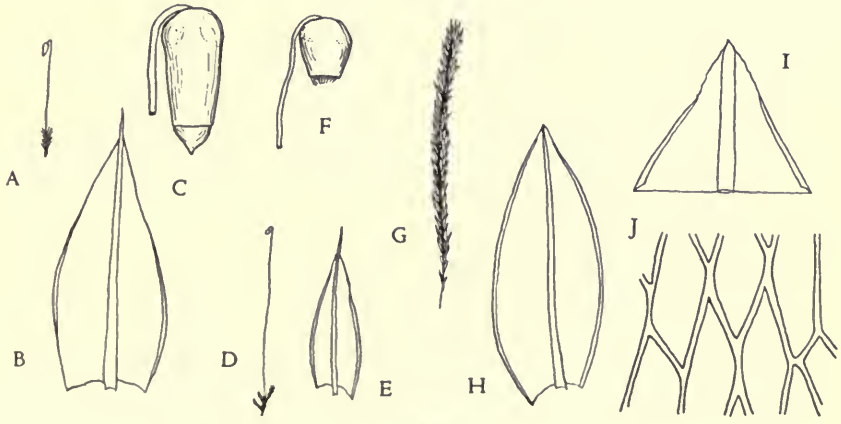

FIGURE 77

A–C, *Bryum coronatum:* A, plant, ×1; B, leaf, ×14; C, capsule, ×8.
D–F, *Bryum microbalanum:* D, plant, ×1; E, leaf, ×14; F, capsule, ×8.
G–J, *Bryum pseudotriquetrum:* G, plant, ×1; H, leaf, ×14; I, apex of leaf, ×54; J, upper leaf cells, ×270.

1.5 mm. long, lanceolate, acuminate; margins recurved below; costa excurrent. Seta 1–2 cm. long, slender, reddish; capsule minute, pendulous, subglobose with a short, thick, rounded neck, about 1 mm. long. (Fig. 77, D–F.)

Dept. Huehuetenango: *Steyermark 49662.*

Distribution: Mexico.

On sandy river flat at rather low altitude. These plants seem to be identical with the type collection from Mexico and are distinguished from *B. coronatum* by the smaller leaves and shorter, subglobose capsules.

7. BRYUM PSEUDOTRIQUETRUM (Hedw.) Schwaegr., Suppl. 1^2: 110. 1816.

Mnium pseudotriquetrum Hedw., Sp. Musc. 109. 1801.

Synoicous or dioicous; plants rather robust, green toward tips, brown and radiculose below. Stems erect, to 5 cm. or more high. Leaves not crowded, contorted when dry, about 3 mm. long, ovate-lanceolate, short pointed; margins entire or slightly toothed toward apex, recurved; costa strong, reddish, percurrent or short excurrent; cells rhomboidal-hexagonal, moderately incrassate, several rows at margins long and narrow forming a distinct border, shorter, broader and reddish at base. Seta to 4 cm. or more long; capsule subpendulous, clavate, with a long neck, to 5–6 mm. long; peristome large, complete. (Fig. 77, G–J.)

Dept. Huehuetenango: *Standley 81180* (as *B. bimum*). Dept. San Marcos: *Steyermark 35971.*

Distribution: United States and northward, Europe, Asia.

Wet alpine meadows. These collections are sterile but the vegetative characters differ in no way from typical plants of farther north.

8. BRYUM CAPILLARE Hedw., Sp. Musc. 182. 1801.

?Bryum Bernoullii C. M., Bull. Herb. Boiss. 5: 183. 1897.

Bryum vulcanicolum C. M., Bull. Herb. Boiss. 5: 184. 1897.

Rather small tufted plants, green or brownish; stems rarely over 1 cm. high. Lower leaves small, distant, upper leaves larger, crowded in a comal tuft, strongly contorted when dry, obovate, cuspidate, often serrulate above; margins recurved below; costa ending below apex to long excurrent; cells broadly hexagonal, thin walled, 2 or 3 rows at margins long and narrow forming a distinct border. Seta

to 3 cm. long; capsule large, often curved, cylindric with a tapering neck; peristome large, complete. (Fig. 79, A–D.)

Dept. Izabal: *Steyermark 39807.* Dept. Huehuetenango: *Standley 81087d; Steyermark 49130, 50268b.* Dept. San Marcos: *Steyermark 36086, 36097, 36103.* Dept. Quezaltenango: *Steyermark 34139, 34630* (as *Brachymenium spirifolium?*); *Standley 67627* (as *Bryum erythroneuron*), *84225, 86005.* Dept. Chimaltenango: *Standley 58740* (as *Brachymenium spirifolium?*). Dept. Guatemala: *Standley 80601a.* Dept. Jutiapa: *Standley 75163, 75671.*

Distribution: Nearly cosmopolitan.

On damp banks, meadows, walls, etc., at medium to high altitudes. The strongly contorted leaves, often spirally twisted when dry, with broad, thin walled cells may usually be relied upon to distinguish this widespread, variable species. No. 36103 cited above is synoicous and represents the form usually referred to as var. *torquescens* (Bry. Eur.) which, as Andrews remarks in his recent treatment of the species north of Mexico, differs only in the synoicous inflorescence.

9. BRYUM CUSPIDATUM (Bry. Eur.) Schimp., Syn. (Ed. 2) 430. 1876.

Bryum bimum var. *cuspidatum* Bry. Eur. fasc. 6/9: 50. 1839.

Synoicous; small, tufted plants. Stems to 5 mm. high, sparingly radiculose. Leaves erect, flexuous and slightly spreading when

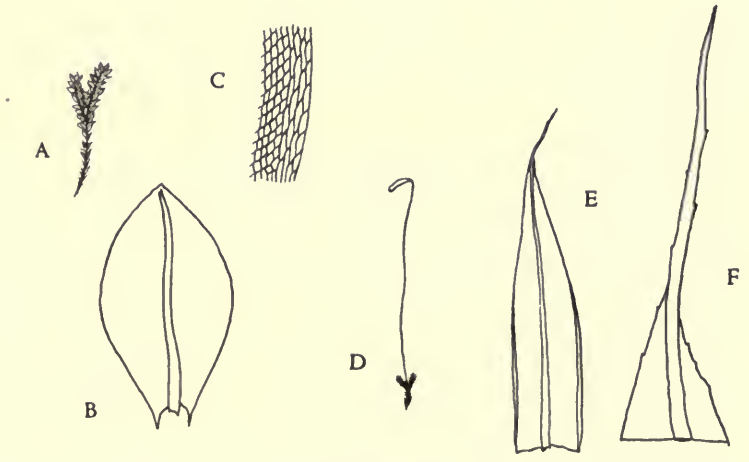

FIGURE 78

A–C, *Bryum mnioides:* A, plant, ×1; B, leaf, ×18; C, upper leaf cells and margin, ×110.

D–F, *Bryum cuspidatum:* D, plant, ×1; E, leaf, ×14; F, apex of leaf, ×66.

moist, to 4 mm. long, oblong-lanceolate, acuminate; margins recurved below, denticulate toward apex; costa long excurrent in a slightly denticulate arista; upper cells linear-rhomboidal, narrower in several rows at margins forming an indistinct border, basal cells oblong, lax, often tinged with red. Seta slender, red, to 3 cm. long; capsules pendulous, ovoid-cylindrical, reddish brown. (Fig. 78, D–F.)

Dept. Baja Verapaz: *Sharp 5156, 5158.*

Distribution: United States and Canada.

On soil at low altitudes. These records are far to the south of the range previously credited to the species in North America but they seem to be typical in all essential particulars.

10. BRYUM TRUNCORUM Brid., Sp. Musc. **3**: 50. 1817.

Bryum andicola Hook. in Kunth, Syn, Pl. Aeq. **1**: 58. 1822.

Bryum streptorhodon C. M., Bull. Herb. Boiss. **5**: 179. 1897.

Dioicous; plants usually in dense tufts, green or yellowish above; stems to 3 cm. high, radiculose below. Leaves contorted when dry, distant below, the upper crowded in a dense, rosulate tuft, 3–3.5 mm. long, 1.5 mm. wide, obovate, short acuminate, usually with numerous brown, septate, cylindrical, papillose propagula in the axils; margins recurved below, toothed above; costa short excurrent; cells rhomboidal-hexagonal, 2–3 rows at margins linear and incrassate forming a distinct border. Seta 1 or 2 from the same perichaetium, 2 cm. or more long; capsule large, subpendulous; peristome complete. (Fig. 79, E–H.)

Dept. Huehuetenango: *Standley 81717, 82553.* Dept. San Marcos: *Standley 66247b.* Dept. Totonicapan: *Standley 65886a, 65888, 83103.* Dept. Quezaltenango: *Standley 65558, 83396, 83805, 85736, 86065; Steyermark 34241.* Dept. Suchitepequez: *Steyermark 46712.* Dept. Sacatepequez: *Standley 59499, 63077.* Dept. Chimaltenango: *Standley 60068, 80038a, 80152, 80323.* Dept. El Progresso: *Steyermark 43698.* Dept. Zacapa: *Steyermark 42640.* Dept. Chiquimula: *Steyermark 30592.* Dept. Jutiapa: *Standley 76320.* Dept. Jalapa: *Steyermark 32263, 32482, 32495, 32816; Standley 76571.* Dept. Santa Rosa: *Standley 78097, 78101.*

Distribution: Texas and Arizona, Mexico, West Indies, South America, also wide in southern hemisphere.

On banks, trees, logs, etc., mostly at medium altitudes. I have followed Andrews' interpretation of this species, which seems a very happy solution of a complex problem. The complete synonymy is evidently very extensive.

11. BRYUM MANGINI Ren. & Card., Rev. Bryol. **36**: 115. 1909.

Robust densely tufted plants; stems to 5 cm. high, evenly and densely foliate, matted together with reddish brown tomentum. Leaves contorted when dry, obovate, short pointed, to 3.5 mm. long, 1.5 mm. wide; margins strongly revolute nearly to apex, bluntly serrulate above; costa percurrent; cells short oval-hexagonal, incrassate, rarely more than twice as long as wide, narrower toward margins but not forming a distinct border, larger and yellowish at base. Seta solitary, slender, 2–3 cm. long; capsule nodding or horizontal, cylindrical with a tapering neck, 4–5 mm. long; peristome complete, endostome with a high basal membrane, cilia 2–3, short, nodose or weakly appendiculate. (Fig. 80, A–C.)

Dept. Huehuetenango: *Steyermark 50185, 50268.* Dept. Chimaltenango: *Standley 58739, 60962, 61857.*

Distribution: Mexico.

On trees, logs and limestone bluffs at high altitudes. This seems to be a well marked species differing from *B. truncorum* in the evenly foliate stems and unbordered leaves with shorter, more incrassate cells.

12. BRYUM GEMINIDENS Bartr., Bryol. **49**: 115. 1946.

Robust, densely tufted, yellowish green plants; stems to 5 cm. high, evenly foliate, densely tomentose. Leaves strongly contorted

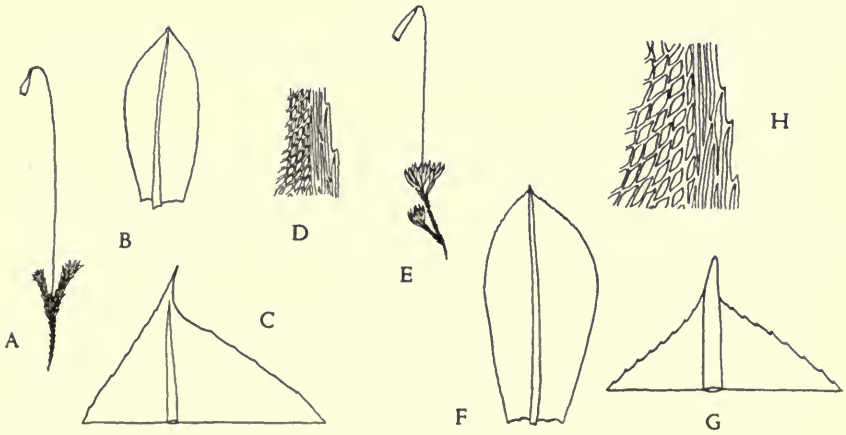

FIGURE 79

A–D, *Bryum capillare:* A, plant, ×1; B, leaf, ×8; C, apex of leaf, ×54; D, upper leaf cells and margin, ×120.

E–H, *Bryum truncorum:* E, plant, ×1; F, leaf, ×8; G, apex of leaf, ×54; H, upper leaf cells and margin, ×120.

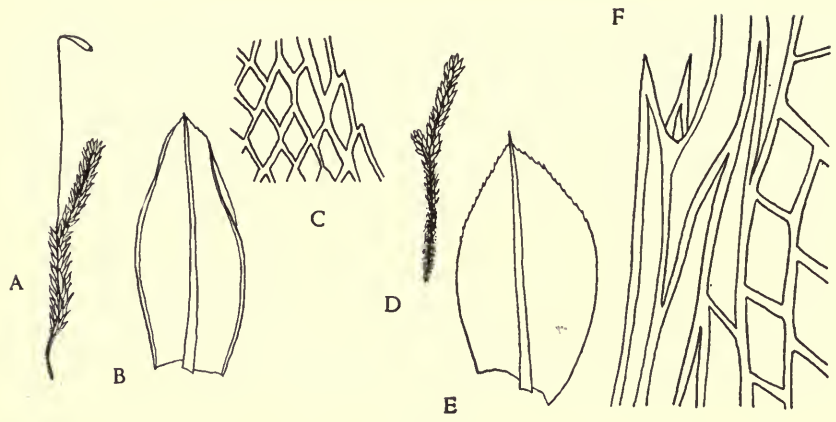

FIGURE 80

A–C, *Bryum Mangini:* A, plant, ×1; B, leaf, ×8; C, upper leaf cells and margin, ×270.

D–F, *Bryum geminidens:* D, plant, ×1; E, leaf, ×8; F, upper leaf cells and margin, ×270.

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when dry, 3.5–4 mm. long, 1.5–2 mm. wide, obovate, abruptly apiculate; margins recurved below, plane and strongly spinose-serrate above with the teeth often paired; cells short, incrassate, oval-hexagonal, about 1:2, several rows at margins long and narrow forming a distinct border; costa excurrent. Sporophyte unknown. (Fig. 80, D–F.)

Dept. San Marcos: Between San Sebastian and summit of Volcan Tajumulco, alt. 3,800–4,600 m., among rocks on top of ridge leading to rocky dome, *Steyermark 35519* TYPE.

Endemic.

Distinct from *B. Mangini* in the plainly bordered leaves, spinose-serrate above with the teeth often in pairs. From *B. procerum* it differs in the leaves, which are not decurrent, and in the shorter, incrassate areolation.

13. BRYUM PROCERUM Schimp., in Besch., Prodr. Bryol. Mex. 55. 1871.

Rhodobryum elatissimum Bartr. in herbaria.

Plants large to very robust, yellowish green; stems to 15 cm. long, evenly foliate, densely tomentose nearly to tips. Leaves not crowded, contorted when dry, to 10 mm. long, ovate-lanceolate, acuminate, decurrent, strongly bordered; margins narrowly recurved below,

plane and spinose-serrate in upper half with the teeth often in pairs; costa ending below apex; cells rhomboid-hexagonal, thin walled, to 100 μ long, very narrow in 3–4 rows at margins forming a distinct, pale border, gradually laxer below. Setae 1–3 from the same perichaetium, red, to 5 cm. long; capsule horizontal, oblong-cylindric with a tapering neck, to 5 mm. long; lid conical; annulus broad, compound; peristome teeth brownish, segments of endostome from a high basal membrane, widely split, cilia 2–3, strongly appendiculate; spores 10–12 μ. (Fig. 81, A–B.)

Dept. Huehuetenango: *Standley 81626, 81768; Steyermark 48391, 50643.* Dept. San Marcos: *Standley 85398, 85432a; Steyermark 35623.* Dept. Totonicapan: *Standley 62714a, 62727, 83101, 84006, 84485.* Dept. Quezaltenango: *Steyermark 34074, 34102.* Dept. Solola: *Steyermark 47513, 47562.* Dept. Chimaltenango: *Standley 58764, 60967, 61109a, 61831.*

Distribution: Mexico.

On damp banks, rocks, trees etc. at medium to high altitudes. In addition to the robust habit these plants are distinguished by the ovate-lanceolate, decurrent and strongly bordered leaves with the margins spinose-serrate above and the elongate, rhomboidal, thin walled cells.

EXCLUDED SPECIES

Bryum pergracilescens C. M., Bull. Herb. Boiss. **5**: 184. 1897.

Bryum perminutum C. M., Bull. Herb. Boiss. **5**: 184. 1897.

No material relating to either of these species is available for comparison.

11. RHODOBRYUM (Schimp.) Limpr., Laubm. **2**: 444. 1892.

Bryum subg. *Rhodobryum* Schimp., Syn. 381. 1860.

Robust terrestrial plants, stoloniferous, in lax mats; stems erect, often interruptedly foliate. Lower leaves small and distant, upper leaves often crowded in rosette-like tufts, bordered, serrate above; costa strong; upper cells rhomboidal, basal cells rectangular. Seta single or aggregated, elongate; capsules large, pendulous; peristome complete.

1. Leaf border 5–6 cells wide above.....2. *R. confluens*
   Leaf border about 2 cells wide above.....2
2. Plants yellowish, leaves oblong, little narrowed below.....3. *R. utriculosum*
   Plants dark green tinged with red, leaves spatulate.....1. *R. Beyrichianum*

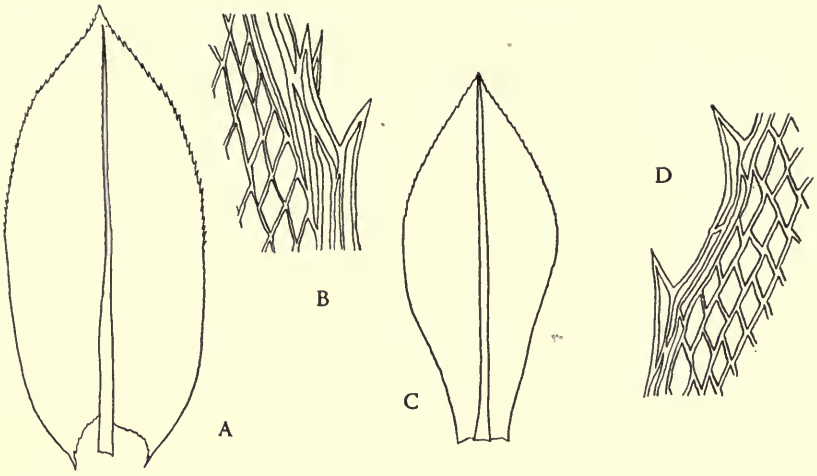

FIGURE 81

A–B, *Bryum procerum:* A, leaf, ×8; B, upper leaf cells and margin, ×120. C–D, *Rhodobryum Beyrichianum:* C, leaf, ×4; D, upper leaf cells and margin, ×120.

1. RHODOBRYUM BEYRICHIANUM (Hornsch.) Par., Ind. Bryol. 1115. 1894–98.

Mnium Beyrichianum Hornsch., Fl. Bras. 1: 45. 1840.

Plants large, dark green tinged with red; stems 2–6 cm. or more high, radiculose below. Lower leaves small, upper much larger, crowded or in rosulate tufts, contorted when dry, to 12 mm. long, 6 mm. wide, broadly spatulate, short acuminate; margins slightly recurved at extreme base, plane and sharply spinose-serrate above; costa strong, percurrent; cells oval-hexagonal, thin walled, 2–3 rows at margins elongate forming a narrow distinct border. Seta 4 cm. or more long; capsule large, curved, cylindric with a tapering neck. (Fig. 81, C–D.)

Dept. Peten: *Lundell 2730; Bartlett 12604, 12636.* Dept. El Progresso; *Steyermark 43530, 43780.* Dept. Chiquimula: *Steyermark 30843.*

Distribution: Mexico, Central America, South America.

On ground at medium altitudes. A critical study of the tropical American species is essential before the species and their respective ranges can be limited with any satisfaction.

2. RHODOBRYUM CONFLUENS (C. M.) Par., Ind. Bryol. 1115. 1894–98.

Bryum confluens C. M., Bull. Herb. Boiss. 5: 179. 1897.

Rather small yellowish green plants, laxly tufted; stems to 6–7 cm. high, proliferous from the comal tufts. Upper leaves in small rosulate tufts, contorted when dry, to 8 mm. long, 4 mm. wide, obovate, short acuminate, strongly bordered; margins recurved more than half way up, plane and serrulate above; costa short excurrent; upper cells oval-hexagonal, thin walled, 25 μ wide, 50 μ long, linear and incrassate in 5–6 rows at margins forming a wide, distinct border, lax and rectangular below. Sporophyte unknown. (Fig. 82, A–B.)

Dept. Huehuetenango: *Steyermark 50076* (as *Bryum truncorum*). Dept. Chimaltenango: *Standley 57819a* (as *R. Beyrichianum*).

Endemic.

Wet, shaded bank at moderately high altitude. I have not seen the original collection but these specimens agree closely with the description and seem to be well distinguished by the widely bordered leaves with short upper cells.

3. RHODOBRYUM UTRICULOSUM (C. M.) Par., Ind. Bryol. 1122. 1894–98.

Bryum utriculosum C. M., Bull. Herb. Boiss. 5: 180. 1897.

Plants robust, yellowish green; stems to 5 cm. high, nearly naked below. Upper leaves in large rosulate tufts, to 11 mm. long, 2.5 mm.

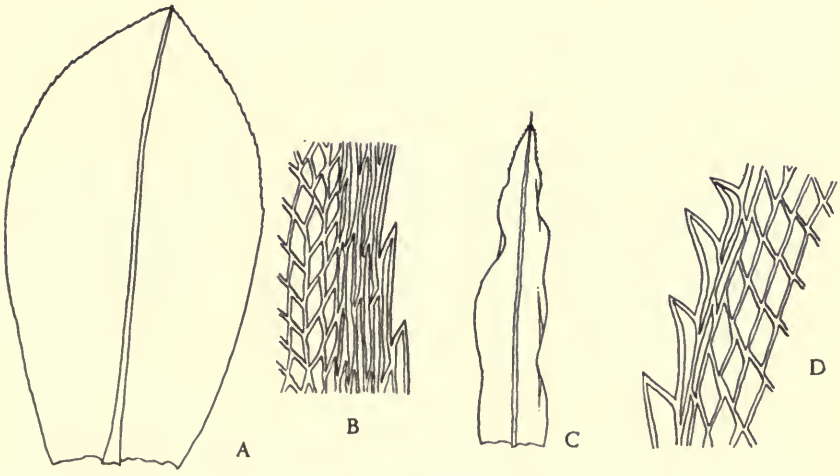

FIGURE 82

A–B, *Rhodobryum confluens:* A, leaf, ×8; B, upper leaf cells and margin, ×120. C–D, *Rhodobryum utriculosum:* C, leaf, ×4; D, upper leaf cells and margin, ×120.

wide, oblong-lanceolate, acuminate; margins recurved about half way up, undulate, plane and sharply serrate above; costa percurrent; upper cells rhomboidal-hexagonal, thin walled, 1:3 or 4, one or two rows at margins elongate forming a narrow, indistinct border, basal cells laxly rectangular. (Fig. 82, C–D.)

Dept. San Marcos: *Steyermark 37278.*

Endemic.

Moist pine slopes at moderate altitude. The oblong leaves from a scarcely narrower base with the margins recurved seem clearly to separate this species from *R. Beyrichianum.* I have not seen the type and the determination is based on the description.

EXCLUDED SPECIES

BRYUM LATO-CUSPIDATUM C. M., Bull. Herb. Boiss. **5**: 180. 1897.

The type is not available and the species cannot be placed from the description.

15. MNIACEAE

Medium sized, broad leaved plants in tufts or mats. Leaves large, the upper often in rosulate tufts, short pointed, bordered, serrate with single or paired teeth; costa strong; cells broadly hexagonal. Seta elongate, single or aggregated; capsules usually pendulous, oblong, short necked; peristome double, complete, bryoid in structure.

1. MNIUM Hedw., Sp. Musc. 188. 1801.

Plants with the characters of the family. Setae often aggregated; capsules oblong-ovoid, subpendulous; peristome double, complete, segments of endostome from a high basal membrane, cilia nodose.

Leaves oblong or obovate, apiculate, marginal teeth single....1. *M. longirostrum*
Leaves ovate, acuminate, marginal teeth in pairs.....2. *M. serratum*

1. MNIUM LONGIROSTRUM Brid., Musc. Recent. **2**[3]: 106. 1803.
Mnium orbifolium C. M., Bull. Herb. Boiss. **5**: 176. 1897.

Synoicous; plants in loose mats; fertile stems about 2 cm. high, sterile stems longer. Leaves large, to 7 mm. long, obovate, rounded above, short apiculate, bordered with 3–4 rows of narrow cells;

margins bluntly serrate with short, single teeth well toward base; costa percurrent; cells rounded-hexagonal with thickened corners. Seta solitary or aggregated, about 2 cm. long; capsule pendulous, oblong, urn to 3 mm. long; lid long rostrate; annulus broad; peristome large and well developed. (Fig. 83, A–D.)

Dept. Alta Verapaz: *Standley 70050, 71629, 91392.* Dept. Huehuetenango: *Steyermark 48756.* Dept. San Marcos: *Steyermark 35731, 37518.* Dept. Chimaltenango: *Standley 61821.* Dept. El Progresso: *Steyermark 43451.* Dept. Zacapa: *Steyermark 42388.* Dept. Chiquimula: *Steyermark 30842.* Dept. Jalapa: *Steyermark 32839.*

Distribution: Cosmopolitan, mostly in tropical and subtropical regions.

On banks, logs, trees, etc., at medium to high altitudes. Frequent and usually fruiting.

2. MNIUM SERRATUM Brid., Musc. Rec. 2^2: 84. 1803.

Synoicous; rather slender, greenish plants, laxly tufted; stems erect, simple, laxly foliate, to 2 cm. high. Leaves crisped when dry, about 3 mm. long, oblong-ovate, short acuminate, with a strong reddish border, serrate with short, usually paired teeth; costa strong, smooth on back, percurrent; upper cells rounded-quadrate with noticeably thickened corners, basal cells more elongate. Seta solitary,

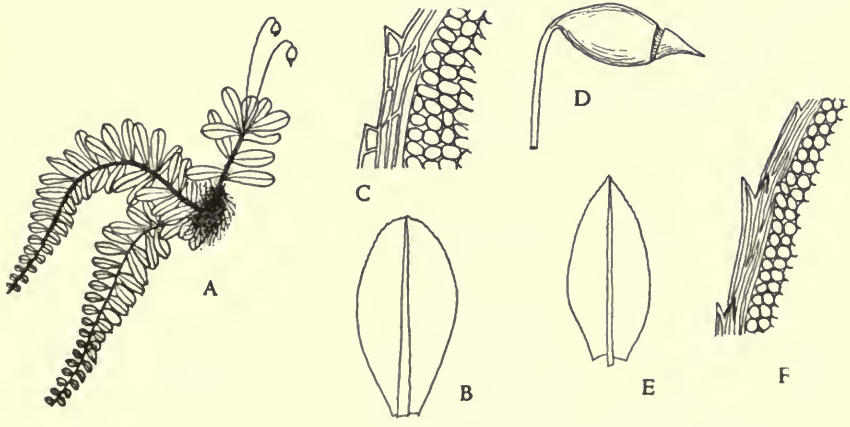

FIGURE 83

A–D, *Mnium longirostrum:* A, plant, ×1; B, leaf, ×4; C, upper leaf cells and margin, ×120; D, capsule, ×4.

E–F, *Mnium serratum:* E, leaf, ×8; F, upper leaf cells and margin, ×120.

to 2 cm. long; capsule large, oblong-cylindric; lid rostrate; peristome complete. (Fig. 83, E–F.)

Dept. San Marcos: *Steyermark 35711a, 35713, 35832.* Dept. Huehuetenango: *Steyermark 48399.*

Distribution: Wide in temperate North America, Europe, Asia.

On wet rocks, banks and in meadows at high altitudes. The local collections are all sterile and often poorly developed but they surely belong here.

16. DREPANOPHYLLACEAE

Small to medium sized laxly tufted plants. Leaves in 4 rows, laterally spreading on both sides, very inequilateral, broad and convex on one side of costa, narrow and concave on the other side; costa percurrent; cells short. Seta terminal, elongate; capsule erect; peristome single.

1. MNIOMALLIA C. M., in Journ. Mus. Godeffr. **5**: 60. 1873–74.

Small, slender, gregarious plants; stems branched, complanate-foliate. Leaves very unequally divided by the costa, obliquely ovate, short pointed; costa strong; cells rounded, smooth or papillose. Sporophyte not seen.

1. MNIOMALLIA VIRIDIS (Mitt.) C. M., Journ. Mus. Godeffr. **5**: 61. 1873–74.

Drepanophyllum viride Mitt., Journ. Linn. Soc. **12**: 318. 1869.
Mniomallia Bernoullii C. M., Bull. Herb. Boiss. **5**: 176. 1897.

Plants to 1 cm. high, dull green; stems branched, often with clustered brood filaments at tips, radiculose below, 1.5 mm. wide with leaves. Leaves numerous, obliquely inserted, to 0.7 mm. long, oblong-ovate, acute, arcuate when moist, overlapping, very asymmetrical; margins narrowly inflexed above and minutely serrulate in upper half; costa strong, nearer the concave side, percurrent; cells rounded-quadrate with firm, pellucid walls, coarsely and distinctly papillose. Sporophyte unknown. (Fig. 84, A–C.)

Dept. Alta Verapaz: *Steyermark 44995a.*

Distribution: Brazil, Ecuador.

On log at medium altitude. This interesting and highly individual species has much the appearance of a small Fissidens to the naked

eye but under a microscope the oddly shaped leaves are unmistakable. I have not seen the original of *M. Bernoullii* but certainly the description suggests nothing different.

17. EUSTICHIACEAE

Slender, bright green plants in dense tufts, interwoven with brownish radicles below; stems branched. Leaves numerous, distichous, deeply carinate, ovate, cuspidate; margins erose-denticulate; costa strong, excurrent; cells small, papillose. Seta slender, elongate; capsules suberect; peristome teeth lacking, endostome of 16 vertically striolate segments, slightly perforate, united at base; lid long and slenderly beaked; calyptra cucullate.

1. EUSTICHIA (Brid.) Mitt., Journ. Linn. Soc. **12**: 603. 1869.

Phyllogonium sect. *Eustichia* Brid., Bryol. Univ. 2: 674. 1827.

Plants with the characters of the family.

1. EUSTICHIA SPRUCEANA (C. M.) Par., Ind. Bryol. Suppl. 153. 1900.

Diplostichum Spruceanum C. M., Hedwigia **36**: 85. 1897.

?Diplostichum miradoricum C. M., Hedwigia **36**: 85. 1897.

Stems to 4 cm. high, considerably branched, about 1 mm. wide with leaves. Leaves spreading, with erect or incurved points, under 1 mm. long, deeply carinate-concave, cuspidate by the strong, pellucid, excurrent costa; margins erect, finely and irregularly denticulate; cells 8–10 μ, rather obscure, papillose, several rows at margins often slightly elongate but not forming a distinct border. Seta 1.5–2 cm. long; capsule ovoid, wide mouthed, erect or curved, sulcate when dry. (Fig. 84, D–F.)

Dept. San Marcos: *Steyermark 35700, 35703, 36448.* Dept. Quezaltenango: *Standley 83745.*

Distribution: Mexico, Costa Rica, South America.

Moist cliffs and bluffs at high altitudes. The various species proposed by Muller in Hedwigia 1897 appear to be based on very trivial distinctions. My numerous specimens from various parts of South America look much alike and I suspect they are merely forms of one broadly distributed species possibly referable to *E. longirostris* (Brid.). Dr. Reimers advised me some years ago that the original of *E. miradorica* (C. M.) from Mexico could not be located in

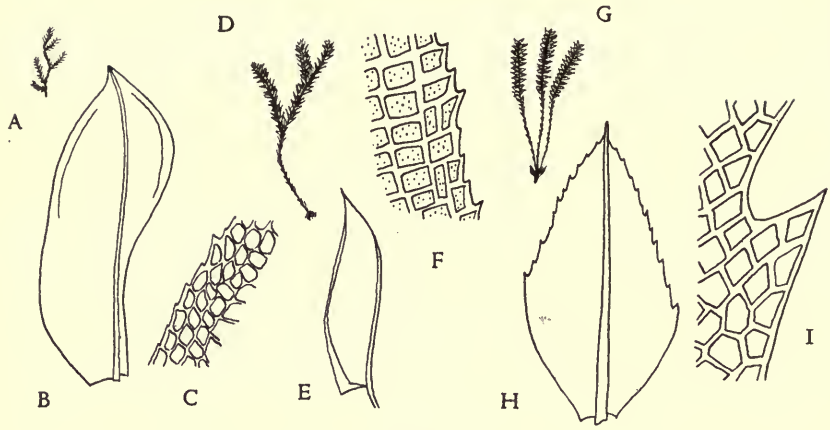

FIGURE 84

A–C, *Mniomallia viridis:* A, plant, ×1; B, leaf, ×54; C, upper leaf cells and margin, ×270.

D–F, *Eustichia Spruceana:* D, plant, ×1; E, leaf, ×28; F, upper leaf cells and margin, ×270.

G–I, *Rhizogonium Lindigii:* G, plant, ×1; H, leaf, ×28; I, upper leaf cells and margin, ×270.

Berlin but the brief description leaves little doubt that it is the same as *E. Spruceana.*

18. RHIZOGONIACEAE

Plants medium sized, densely tufted; stems erect, radiculose below. Leaves narrow, spreading, strongly serrate with single or paired teeth; costa strong; cells small, rounded, incrassate, smooth. Setae elongate, lateral near base of stem; capsule nodding or horizontal, curved; lid beaked; annulus present; peristome double, complete.

1. RHIZOGONIUM Brid., Bryol. Univ. **2**: 663. 1827.

Plants with the characters of the family.

Leaves in 2 rows, bifarious, serrate with single teeth.....1. *R. Lindigii*
Leaves spreading on all sides, serrate with paired teeth.....2. *R. spiniforme*

1. RHIZOGONIUM LINDIGII (Hampe) Mitt., Journ. Linn. Soc. **12**: 328. 1869.

Mnium Lindigii Hampe, Ann. Sci. Nat. ser. V, **4**: 345. 1865.

Dioicous; slender, yellowish brown, glossy plants; stems about 2 cm. high, nearly naked below, flexuous. Lower leaves small and distant, the upper numerous in 2 opposite rows, 1–1.5 mm. long, ovate, cuspidate by the excurrent costa, not bordered, coarsely incised serrate with simple teeth. Inflorescence basal. Sporophyte not seen. (Fig. 84, G–I.)

Dept. Zacapa: *Steyermark 43289.*

Distribution: Costa Rica, Colombia, British Guiana, Brazil.

On shaded bluffs at high altitude. The bifarious, unbordered leaves distinguish this species at a glance. This is the northern limit of the range as now known.

2. RHIZOGONIUM SPINIFORME (Hedw.) Bruch, Flora **29**: 134. 1846.

Hypnum spiniforme Hedw., Sp. Musc. 236. 1801.

Normally synoicous; inflorescence basal. Plants yellowish green in deep tufts, densely radiculose at base; stems to 3–5 cm. high, flexuous. Leaves numerous, not crowded, linear-lanceolate, gradually acuminate, to 8 mm. long; margins thickened, spinose-serrate with paired teeth from near base; costa strong, toothed on back above; cells rounded, incrassate, several rows at margins in 2 layers forming a thickened border. Seta slender, flexuous, to 7 cm. long; capsule nodding or horizontal, curved; lid obliquely beaked; peristome teeth brownish, close, segments of endostome narrow from a high basal membrane, cilia nodose. (Fig. 85, A–C.)

Dept. Izabal: *Steyermark 38895, 41895.* Dept. Alta Verapaz: *Standley 90412, 90421, 90433, 91420, 91662, 91667, 91962.* Dept. Huehuetenango: *Steyermark 48798.* Dept. San Marcos: *Steyermark 37260.* Dept. Zacapa: *Steyermark 29829, 42556, 43225.* Dept. Chiquimula: *Steyermark 30815.*

Distribution: Cosmopolitan in tropical and subtropical regions reaching the southeastern United States.

On logs, trees and humus at low altitudes. Frequent and usually fruiting.

19. MEESEACEAE

Plants of bogs and wet places; stems erect. Leaves spreading, lanceolate, cells small, smooth; costa single, strong. Seta terminal, long; capsules curved, with a long, prominent neck; peristome double, the teeth usually blunt and shorter than the segments, cilia rudimentary; lid short, conical.

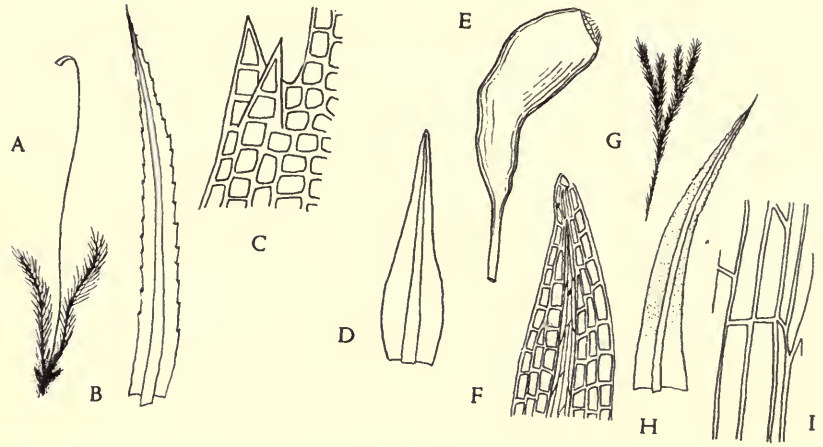

FIGURE 85

A–C, *Rhizogonium spiniforme:* A, plant, ×1; B, leaf, ×8; C, upper leaf cells and margin, ×270.
D–F, *Meesea longiseta:* D, leaf, ×8; E, capsule, ×8; F, apex of leaf, ×120.
G–I, *Anacolia laevisphaera:* G, plant, ×1; H, leaf, ×14; I, basal leaf cells, ×270.

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1. MEESEA Hedw., Sp. Musc. 173. 1801.

Plants with the characters of the family. Leaves decurrent; costa ending below apex. Segments of endostome often transversely connected.

1. MEESEA LONGISETA Hedw., Sp. Musc. 173. 1801.

Synoicous; plants rather densely tufted, yellowish green; stems densely radiculose below. Leaves numerous, contorted when dry, lanceolate from an ovate base, to 3–4 mm. long, acute or blunt at apex; margins entire, plane or narrowly recurved toward base; costa ending below apex; upper cells rhomboidal, 2–4:1, rectangular toward base. Seta to 8 or 10 cm. long but often shorter; capsule curved, nodding, pyriform with a long neck; peristome teeth short, obtuse, segments of endostome much exceeding the teeth. (Fig. 85, D–F.)

Dept. Alta Verapaz: *Standley 92739.*

Distribution: Rare and local in North America, Honduras (as *M. Ulei* C. M.), Europe, Asia.

Terrestrial in bogs at moderate altitude. The unexpected occurrence of this species in Guatemala naturally led to a comparison with Standley's No. 56214a from Honduras, which I referred to

M. Ulei C. M. After comparing the two Central American collections with each other and with *M. longiseta* I am convinced that they are identical. The leaves of *M. longiseta* are invariably described as plane margined but I find the basal edges are often narrowly recurved on one or both sides.

20. BARTRAMIACEAE

Small to robust tufted plants; stems branched or with whorled subfloral innovations. Leaves usually narrow and acute; cells narrow, papillose at or near end walls. Setae short or long; capsules mostly globose and cernuous, ribbed when dry. Peristome usually double or imperfect, teeth 16, segments of endostome shorter than teeth, often poorly developed; lid convex or conical.

1. Seta short, 2–3 mm. long.....2
   Seta elongate.....3
2. Peristome lacking, dioicous.....1. *Anacolia*
   Peristome present, synoicous.....2. *Leiomela*
3. Synoicous, very small plants.....4. *Bartramidula*
   Dioicous, plants larger.....4
4. Leaves plicate, at least at base, alar cells differentiated.....6. *Breutelia*
   Leaves not plicate, alar cells not differentiated.....5
5. Leaves linear-lanceolate from a sheathing base.....3. *Bartramia*
   Leaves lanceolate, not sheathing at base.....5. *Philonotis*

1. ANACOLIA Schimp., Syn. Ed. 2, 513. 1876.

Dioicous; plants fairly large, tufted, densely felted with brown tomentum below. Leaves appressed when dry, lanceolate; costa stout, percurrent or excurrent; margins recurved below, plane and serrate above; cells oblong, usually papillose. Seta terminal, short; capsules nearly erect, subglobose; peristome lacking or of 16 fragile, rudimentary teeth.

Basal cells elongate, lamina cells in 2 layers.....1. *A. laevisphaera*
Basal cells short, lamina cells in 1 layer.....2. *A. intertexta*

1. ANACOLIA LAEVISPHAERA (Tayl.) Flowers, Moss Fl. of No. Amer. 2^3: 155. 1935.

Glyphocarpus laevisphaera Tayl., Lond. Journ. Bot. **1846**: 56. 1846.
Bartramia subsessilis Tayl., Lond. Journ. Bot. **1847**: 334. 1847.

Plants yellowish green, closely tufted; stems 2–4 cm. long, branched. Leaves crowded, erect with flexuous points when dry,

3–4 mm. long, narrowly lanceolate, long acuminate, sharply serrate above; costa excurrent; upper cells in 2 layers, oblong, papillose, basal cells rectangular, to 65 μ long, shorter toward margins. Seta 2–3 mm. long; capsule erect, globose, 2 mm. in diameter, small mouthed; peristome none as seen; spores papillose, about 25 μ. (Fig. 85, G–I.)

Dept. Quezaltenango: *Standley 84170.*

Distribution: Arizona, New Mexico, Mexico, wide in South America.

On damp bank at high altitude. Uniformly sterile in North America as far as I know but readily known by the elongated basal leaf cells and the bistratose upper cells. The sporophyte characters are described from fruiting plants collected in Ecuador.

2. ANACOLIA INTERTEXTA (Schimp.) Jaeg., Adumb. **2**: 699. 1879.

Bartramia intertexta Schimp. in C. M., Syn. **1**: 503. 1849.

Robust plants, yellowish, strongly tinged with brown, growing in extensive mats; stems slender, decumbent, to 7 or 8 cm. long, copiously branched, densely felted with red tomentum nearly to tips. Leaves appressed when dry, 3 mm. long, lanceolate from an ovate, plicate base, subulate-acuminate; margins strongly recurved more than half way up, serrulate nearly to base; costa excurrent; cells rounded, incrassate, in one layer, coarsely papillose, narrower toward margins but not elongate below. Perichaetial leaves longer, setaceous pointed; seta 2–3 mm. long, curved; capsule large, globose, pale brown, glossy, diameter 3 mm.; peristome none. (Fig. 86, A–C.)

Dept. Huehuetenango: *Standley 81090, 81677, 81691, 81852, 83088a; Steyermark 50231.* Dept. San Marcos: *Steyermark 35896* (c. fr.). Dept. Quezaltenango: *Steyermark 34764, 34765; Standley 84180.* Dept. Solola: *Steyermark 46932.*

Distribution: Mexico.

On limestone rocks, banks and trees at high altitudes. Mitten confused this species with *A. setifolia* as explained by Thériot. The short, rounded distinct leaf cells of *A. intertexta* are very distinctive.

2. LEIOMELA (Mitt.) Broth., E. & P. Pflanzenf. 1^3: 634. 1904.

Bartramia subsec. *Leiomela* Mitt. in part, Journ. Linn. Soc. **12**: 253. 1869.

Synoicous; robust, dull yellowish green plants, densely tufted, felted with brown tomentum below; stems erect, branched. Leaves narrow, setaceous, serrulate; costa long excurrent; cells narrowly

rectangular, papillose at apical angles. Perichaetial leaves longer than stem leaves; seta terminal, short; capsule ovoid; lid plano-convex; peristome teeth 16, deeply inserted, endostome rudimentary.

1. LEIOMELA BARTRAMIOIDES (Hook.) Par., Ind. Bryol. Ed. 2, **3**: 132. 1905.

Leucodon bartramioides Hook., Ic. Pl. Rar. **1**: tab. 71. 1837.

Stems to 7 cm. high. Leaves crowded, erect-spreading when dry, to 8 mm. long, linear-subulate from an erect, pale, oblong base; margins plane, minutely serrulate nearly to base; costa excurrent, toothed on back above; upper cells oblong, obscure, coarsely papillose, basal cells linear, smooth, hyaline, brownish near insertion. Perichaetial leaves 14–16 mm. long, with long, fragile, capillary, concolorous points; seta 1 mm. or less long; capsule immersed, 2.5 mm. long, 1.5 mm. wide, pale and rather glossy, smooth; peristome teeth irregularly cleft. (Fig. 86, D–F.)

Dept. Alta Verapaz: *Standley 71682*. Dept. Huehuetenango: *Steyermark 48754, 49790* (c. fr.). Dept. San Marcos: *Standley 68552a*. Dept. Quezaltenango: *Standley 85997, 86013a*. Dept. Chimaltenango: *Standley 61080*.

Distribution: Costa Rica, Jamaica, South America.

On trees at medium to high altitudes. Easily recognized by the very narrow, plane margined leaves and immersed capsules. Numer-

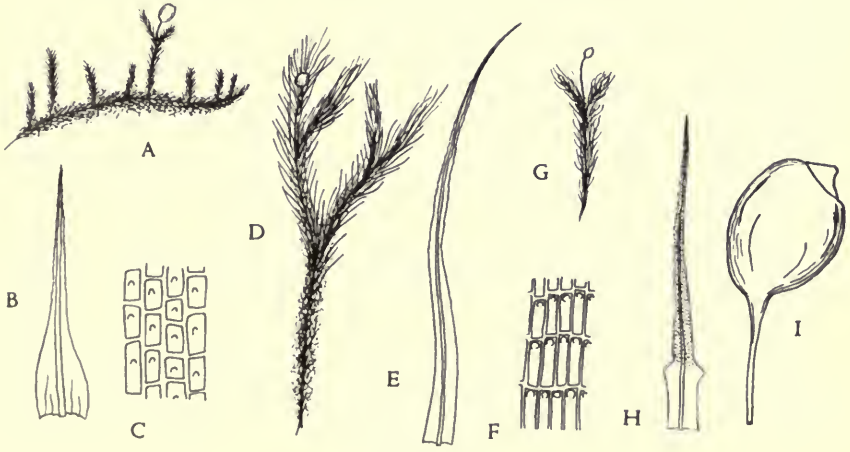

FIGURE 86

A–C, *Anacolia intertexta:* A, plant, ×1; B, leaf, ×14; C, basal leaf cells, ×270. D–F, *Leiomela bartramioides:* D, plant, ×1; E, leaf, ×8; F, upper leaf cells, ×270.

G–I, *Bartramia microstoma:* G, plant, ×1; H, leaf, ×8; I, capsule, ×8.

ous purplish or brown, naked, filiform shoots are often produced near the tips of the sterile stems. These shoots bear clusters of rhizoids from which grow minute plants.

3. BARTRAMIA Hedw., Sp. Musc. 164. 1801.

Plants erect, tufted, bright or yellowish green; stems branched. Leaves narrow, serrulate; costa strong, often excurrent; upper cells quadrate or elongate, papillose, obscure, basal cells linear, smooth. Seta short to elongate; capsules exserted, subglobose, furrowed when dry; peristome double, single or none, endostome often rudimentary. The local species all belong in the section *Vaginella*.

1. Perichaetial leaves to 10–12 mm. long, much longer than stem leaves ..... 3. *B. Mathewsii*
   Perichaetial leaves not differentiated 2
2. Leaves erect, rigid, appressed when dry ..... 2. *B. potosica*
   Leaves with spreading points when dry ..... 1. *B. microstoma*

1. BARTRAMIA MICROSTOMA Mitt., Journ. Linn. Soc. **12**: 272. 1869.

Synoicous; plants compactly tufted, green above, brown below; stems 2–4 cm. high. Leaves crowded, suberect with spreading, curved points when dry, 3–5 mm. long, linear-subulate from an erect, oblong, hyaline, sheathing base, wider at shoulders than below, subula opaque, serrulate; margins narrowly recurved just above shoulders, plane above; costa obscure above, excurrent; upper cells small, oblong, obscure, papillose. Seta slender, 6–8 mm. long, straight or curved; capsule nodding, ovoid, 1.5 mm. long, small mouthed; peristome teeth reddish brown, about 225 μ long, endostome rudimentary; lid convex with a blunt point; spores reniform, to 28 μ long. (Fig. 86, G–I.)

Dept. San Marcos: *Steyermark 36116* (as *B. Mathewsii*). Dept Quezaltenango: *Standley 66408, 66414, 67749a.* Dept. Sacatepequez: *Standley 65202.*

Distribution: Arizona.

On shaded banks at rather high altitudes. The sporophyte is very similar to that of *B. potosica* excepting the endostome, which appears to be constantly more rudimentary.

2. BARTRAMIA POTOSICA Mont., Ann. Sci. Nat. Ser. II, **9**: 56. 1838.

Dioicous; plants yellowish green; stems 2–3 cm. high, usually simple, densely radiculose below. Leaves rigidly erect and appressed

when dry, fragile, points often broken off, 4–6 mm. long, abruptly linear-subulate from an erect, oblong, hyaline base, broader at shoulders than below, subula opaque, sharply serrulate; costa obscure above, excurrent; upper cells narrowly oblong, obscure, papillose. Seta 3–6 mm. long, usually curved; capsule suberect, ovoid, glossy, 1.5–2 mm. long; peristome double, teeth brown, segments of endostome shorter than teeth; spores reniform, 22–28 μ. (Fig. 87, A–D.)

Dept. Totonicapan: *Standley 65936*. Dept. Quezaltenango: *Steyermark 34192, 34193*.

Distribution: Mexico, Colombia to Chile.

On shaded banks and rocks at high altitudes. Noticeably distinct from *B. microstoma* in the rigidly erect, fragile leaves. Brotherus includes this species in the dioicous group while Mitten describes it as synoicous. The plants I have examined are dioicous but the inflorescence may be variable.

3. BARTRAMIA MATHEWSII Mitt., Journ. Linn. Soc. **12**: 273. 1869.

Dioicous? Plants yellowish green above, brown below; stems simple or sparingly branched, to 3 cm. high. Leaves crowded, erect, appressed, brittle, the points often broken off, 4–6 mm. long, similar

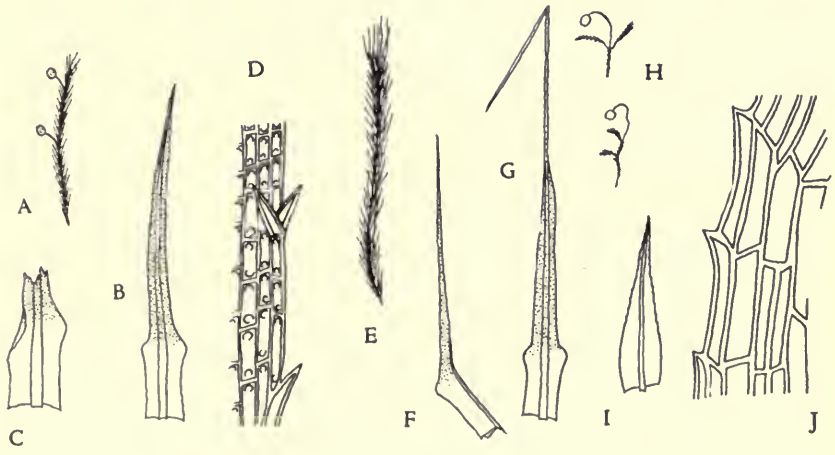

FIGURE 87

A–D, *Bartramia potosica:* A, plant, ×1; B, leaf, ×8; C, broken leaf, ×8; D, upper leaf cells and margin, ×270.

E–G, *Bartramia Mathewsii:* E, plant, ×1; F, stem leaf, ×8; G, comal leaf, ×8.

H–J, *Bartramidula patula:* H, two plants, ×1; I, leaf, ×22; J, upper leaf cells and margin, ×346.

in structure to those of *B. potosica;* margins narrowly recurved just above shoulders. Perichaetial leaves much longer, 10–12 mm. long, with long, capillary, concolorous points; capsule erect, oblong, globose; peristome imperfect, teeth none? Segments well developed. Sporophyte not seen. (Fig. 87, E–G.)

San Marcos: *Steyermark 35546b, 35544, 36115.*

Distribution: Ecuador, Peru.

Rock crevices and boulders at very high altitudes. The conspicuously long pointed perichaetial leaves are suggestive of Leiomela but the stem leaves follow the pattern of Bartramia. These collections agree perfectly with the original collection by Mathews from Peru.

Brotherus interprets Mitten's ambiguous description of the sporophyte to mean that the inner peristome only is present. However a single capsule in a collection from Chile on the sheet bearing the type specimen shows a short, curved seta about 4 mm. long and the teeth of the outer peristome well developed. Until this problem is clarified the peristome structure must remain in doubt.

4. BARTRAMIDULA Schimp., Bry. Eur. fasc. **29–30.** 1846.

Small, slender plants with whorled, subfloral innovations. Leaves small, lanceolate, erect-spreading; costa percurrent; cells oblong, papillose. Seta slender, straight or curved; capsule small, subglobose; peristome usually lacking.

Peristome lacking.....1. *B. patula*

Peristome present.....2. *B. Turckheimi*

1. BARTRAMIDULA PATULA (Mitt.) Jaeg., Adumb. **2:** 698. 1877–78.

Bartramia patula Mitt., Journ. Linn. Soc. 12: 255. 1869.

Synoicous; plants less than 1 cm. high with several slender subfloral innovations. Leaves erect-spreading, 1–1.5 mm. long, lanceolate, acuminate; margins plane, serrate above middle; costa percurrent; cells narrowly oblong to linear, smooth to very faintly papillose. Seta 5–8 mm. long, flexuous or arcuate, slender; capsule globose-pyriform, brown, rugulose, about 1.5 mm. long, mouth small; peristome lacking. (Fig. 87, H–J.)

Volcan de Agua; *Godman & Salvin.*

Endemic.

Evidently a rare, local species. The only plants I have seen are from the Mitten Herbarium in New York.

2. BARTRAMIDULA TURCKHEIMI (C. M.) Par., Ind. Bryol. Suppl. 36. 1900.

Bartramia Turckheimi C. M., Bull. Herb. Boiss. 5: 187. 1897.

Synoicous; small, densely tufted plants, yellowish green, matted together with brown tomentum below. Stems to 7 mm. high, tipped with 4–6 short, whorled innovations. Leaves crowded, erect-spreading, to 2 mm. long, narrowly lanceolate, slenderly acuminate; margins recurved; costa excurrent in a long, denticulate hair-point; leaf cells linear, papillose at upper ends. Seta curved, to 7 mm. long; capsule globose, sulcate, 1.5 mm. in diameter; peristome double, teeth about 110 μ high, broad, brownish, truncate, smooth, endostome rudimentary, fragments as long as teeth, pale yellow, minutely papillose, segments and cilia lacking; spores brown, diameter 40–45 μ. (Fig. 88, A–C.)

Dept. El Quiche: *Sharp 2568.*

Endemic.

On bank at moderate altitude. This is a noteworthy collection as the species is apparently known only from the type gathering by

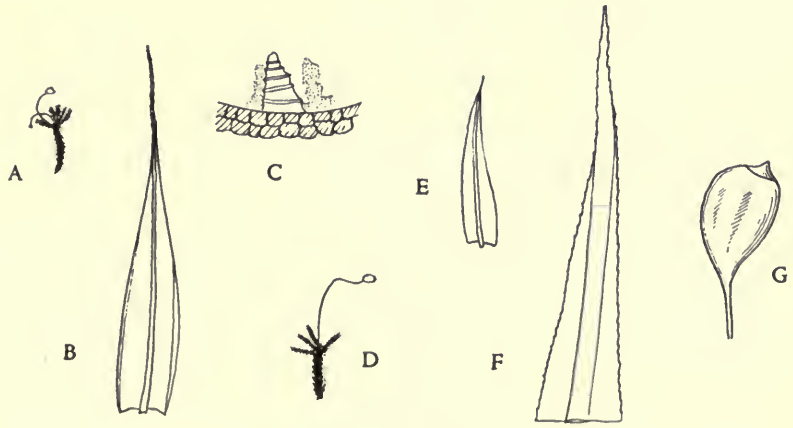

FIGURE 88

A–C, *Bartramidula Turckheimi:* A, plant, ×1; B, leaf, ×26; C, part of peristome, ×68.

D–G, *Philonotis Bernoullii:* D, plant, ×1; E, leaf, ×28; F, apex of leaf, ×68; G, capsule, ×8.

Turckheim from near Coban, Alta Verapaz, and no material is available in the American herbaria. Muller describes the capsules as gymnostomous but Brotherus notes (E. & P. Ed. 2, **10**: 460) that an examination of an unripe capsule from the type collection shows a peristome structure but only fragments of the outer peristome were seen. This observation is confirmed by Sharp's collection, which is in good fruit and shows the peristome described above.

5. PHILONOTIS Brid., Bryol. Univ. **2**: 15. 1827.

Plants of varying size, partial to wet places. Stems with whorled, subfloral branches. Leaves appressed when dry, lanceolate; costa strong, percurrent or excurrent; cells narrow, usually papillose. Seta elongate; capsules subglobose, cernuous, furrowed when dry; peristome double, teeth 16, segments of endostome from a high basal membrane, cilia well developed.

1. Autoicous ..... 1. *P. longiseta*
   Dioicous 2
2. Stems hooked at tips ..... 6. *P. uncinata*
   Stems not hooked 3
3. Leaves obtuse, costa ending below apex ..... 3. *P. gracillima*
   Leaves acute or acuminate, costa percurrent or excurrent 4
4. Costa percurrent ..... 2. *P. glaucescens*
   Costa long excurrent 5
5. Robust plants, seta erect, 2 cm. or more long ..... 4. *P. sphaericarpa*
   Very slender plants, setae flexuous or curved, less than 1.5 cm. long
   5. *P. Bernoullii*

1. PHILONOTIS LONGISETA (Rich.) E. G. Britt., Bryol. **14**: 44. 1911.

Bartramia longiseta Rich. in Michx., Fl. Am. Bor. **2**: 301. 1803.

Bartramia graminicola C. M., Linnaea **38**: 632. 1874.

Autoicous; plants green, tufted, tomentose below; stems about 2 cm. high. Leaves 1–1.5 mm. long, lanceolate, acuminate; costa excurrent; margins revolute, serrulate; cells linear, papillose at upper ends. Seta about 2.5 cm. long; capsule nodding, 2 mm. long. (Fig. 89, A–C.)

Dept. Quezaltenango: *Standley 85907*. Dept. Zacapa: *Steyermark 43187*.

Distribution: Eastern and southeastern United States, Mexico.

On damp banks at moderate to rather high altitudes. There seems to be no appreciable difference between *P. graminicola* (C. M.) and *P. longiseta*. If anything the setae are a little longer in the

Guatemalan plants, nearly 3 cm. at times, but this is an inconstant character.

2. PHILONOTIS GLAUCESCENS (Hornsch.) Par., Ind. Bryol. 923. 1894.

Bartramia glaucescens Hornsch., Fl. Bras. **1**: 40. 1840.

Bartramia tenella C. M., Syn. **1**: 481. 1849.

?Bartramia scobinifolia C. M., Bull. Herb. Boiss. **5**: 188. 1897.

Dioicous; small plants, pale green; stems slender. Leaves crowded, often subfalcate, less than 1 mm. long, lanceolate, acuminate; costa percurrent; margins recurved; cells linear-oblong, papillose at upper ends. Seta 1–1.5 cm. long, erect; capsule inclined, ovoid, furrowed when dry. (Fig. 89, D–G.)

Dept. Izabal: *Steyermark 41782; H. Johnson 1123.* Dept. Alta Verapaz: *Steyermark 44392, 45815, 45817; Standley 71748.* Dept. Huehuetenango: *Standley 82307; Steyermark 51169, 51170.* Dept. San Marcos: *Standley 66247a; Steyermark 35710.* Dept. Quezaltenango: *Standley 65481, 67856, 84818, 87051, 87216; Steyermark 35163.* Dept. Sacatepequez: *Standley 59357, 59957, 62177, 63285.* Dept. Chimaltenango: *Standley 62053, 79724, 80852.* Dept. Jutiapa: *Standley 75584.* Dept. Jalapa: *Steyermark 32135, 32916, 32990.* Dept. Santa Rosa: *Standley 77781.*

Distribution: Southern United States, Mexico, West Indies, Central and South America.

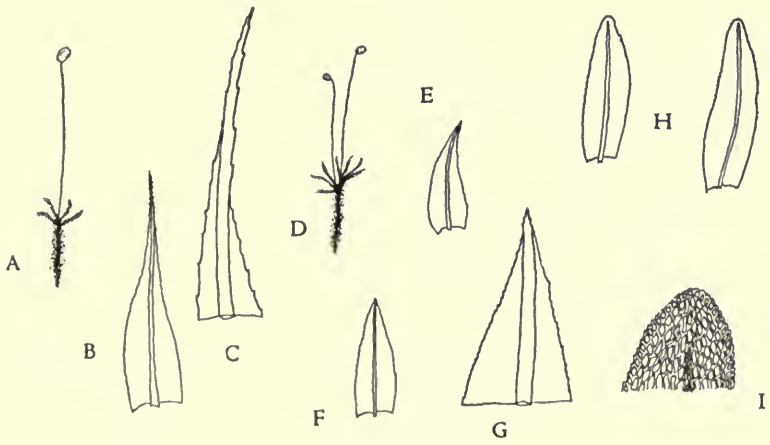

FIGURE 89

A–C, *Philonotis longiseta:* A, plant, ×1; B, leaf, ×26; C, apex of leaf, ×120.
D–G, *Philonotis glaucescens:* D, plant, ×1; E and F, leaves, ×24; G, apex of leaf, ×120.
H–I, *Philonotis gracillima:* H, leaves, ×24; I, apex of leaf, ×120.

On damp banks and rocks at low and medium altitudes. Frequent and widely distributed. The small leaves with the costa percurrent and margins recurved simplify the recognition of this rather variable species.

3. PHILONOTIS GRACILLIMA Aongstr., Oefv. Sv. K. Vet.-Akad. Forh. **33**: 17. 1876.

Dioicous; small, slender, green plants; stems to 1.5 cm. long. Leaves oblong-ovate, bluntly pointed, to 1 mm. long; margins plane or recurved, bluntly serrulate; costa ending below apex; cells oblong to rhomboidal, weakly papillose at upper ends. Sporophyte as in *P. glaucescens*. (Fig. 89, H–I.)

Dept. San Marcos: *Steyermark 35729, 36884.* Dept. Chimaltenango: *Standley 57909, 61554.* Dept. Guatemala: *Standley 62961.* Dept. Zacapa: *Steyermark 29413a.*

Distribution: Southern United States, Mexico, West Indies, Central and South America.

On damp banks at medium altitudes. This species intergrades with *P. glaucescens* but may usually be separated, since some of the leaves are obtusely rounded with the costa ending below the tip, and the upper cells are broader and more pellucid.

4. PHILONOTIS SPHAERICARPA (Hedw.) Brid., Bryol. Univ. **2**: 25. 1827.

Mnium sphaericarpum Hedw., Sp. Musc. 197. 1801.

?Bartramia chrysoblasta C. M., Bull. Herb. Boiss. **5**: 188. 1897.

Dioicous; plants rarely over 2–3 cm. high, yellowish green, tomentose below. Leaves erect, closely imbricated, oblong-lanceolate, slenderly acuminate, 1.5–2 mm. long; margins revolute, sharply serrulate; costa long excurrent in a slender, spinulose point; cells linear, papillose at upper ends, oblong below. Seta 2–2.5 cm. long; capsule cernuous, subglobose, brown, furrowed when dry, 2 mm. long. (Fig. 90, A–C.)

Dept. Huehuetenango: *Steyermark 50083.* Dept. San Marcos: *Steyermark 37313, 37315.* Dept. Quezaltenango: *Standley 84827, 84830; Steyermark 33621.* Dept. Solola: *Steyermark 47425, 47487.*

Distribution: Florida, Mexico, West Indies, Central and South America.

On damp banks at medium to high altitudes. Distinguished from *P. glaucescens* by the long excurrent costa and from *P. uncinata* by the erect leaves.

5. PHILONOTIS BERNOULLII (C. M.) Par., Ind. Bryol. Suppl. 265. 1900.

Bartramia Bernoullii C. M., Bull. Herb. Boiss. 5: 187. 1897.

Dioicous? No antheridial buds seen. Slender, yellowish green plants, laxly gregarious. Stems 6–8 mm. high, erect, densely tomentose, with 4–6 slender, whorled innovations about 5 mm. long. Leaves appressed, under 1 mm. long, narrowly triangular-lanceolate, slenderly acuminate; margins narrowly recurved; costa long excurrent in a denticulate, concolorous point; cells narrowly rectangular, papillose at upper ends, wider and laxer toward base. Seta slender, red, 12–14 mm. long, flexuous or slightly curved; capsules subglobose, about 2 mm. in diameter, sulcate when dry; peristome double, teeth acuminate, 200 μ high, segments of endostome nearly as long as teeth; spores reniform, diameter 20–25 μ. (Fig. 88, D–G.)

Dept. Suchiate: *Svihla 2872.* Dept. Guatemala: *Svihla 2800, 2801.*

Endemic.

On damp soil at moderate altitudes. A considerable risk is assumed in naming a species without authentic material for comparison but in this instance the plants agree so closely with the original description that I am reasonably confident the name is correctly applied.

The extremely slender stems clothed with minute, narrow leaves, gradually tapering to a long, setaceous point formed by the excurrent costa, and the filiform, flexuous or even arcuate setae are widely different from any form of *P. sphaericarpa* (Hedw.) Brid.

6. PHILONOTIS UNCINATA (Schwaegr.) Brid., Bryol. Univ. **2**: 22. 1827.

Bartramia uncinata Schwaegr., Suppl. 1²: 60. 1816.

Dioicous; plants very similar to *P. sphaericarpa* but with the upper leaves falcate and hooked at the tips of the stems. Setae to 2.5 cm. or more long. (Fig. 90, D–E.)

Dept. Alta Verapaz: *H. Johnson 982.*

Distribution: Southern United States, Mexico, West Indies, Central and South America.

On clay bank. This is the only collection I have seen from Guatemala but it may prove to be more widely distributed locally.

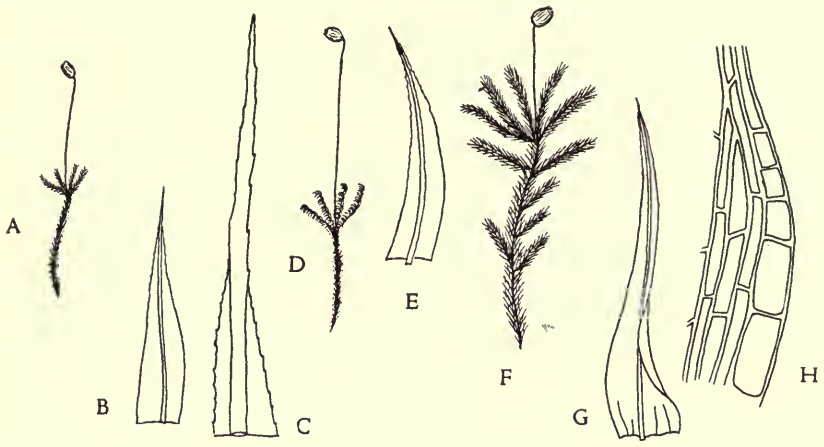

FIGURE 90

A–C, *Philonotis sphaericarpa:* A, plant, ×1; B, leaf, ×28; C, apex of leaf, ×120.
D–E, *Philonotis uncinata:* D, plant, ×1; E, leaf, ×28.
F–H, *Breutelia tomentosa:* F, plant, ×1; G, leaf, ×14; H, basal angle of leaf, ×270.

6. BREUTELIA Schimp., Coroll. 85. 1856.

Dioicous; male flower discoid. Usually robust plants with erect, branched stems, densely tufted. Leaves lanceolate, acuminate, plicate at base; margins serrulate; cells linear, papillose, well differentiated at basal angles. Seta usually elongate; capsules cernuous, furrowed; peristome double, endostome with well developed segments, cilia rudimentary; lid short, convex.

1. Leaf base erect and sheathing 2
   Leaves spreading from insertion, base not sheathing 3
2. Stems slender, leaf base sulcate, often with a pocket on either side of costa near shoulders ..... 5. *B. Brittoniae*
   Stems robust, leaf base plicate, without pockets ..... 6. *B. deflexifolia*
3. Seta short, arcuate ..... 2. *B. subarcuata*
   Seta elongate, straight 4
4. Basal cells quadrate across width of leaf ..... 3. *B. jamaicensis*
   Quadrate alar cells few or none 5
5. Basal angles of leaf laxly areolate, decurrent ..... 4. *B. auriculata*
   Basal angles of leaf not as above ..... 1. *B. tomentosa*

1. BREUTELIA TOMENTOSA (Sw.) Schimp., in Ind. Bryol. 155. 1894.

Bryum tomentosum Sw., Fl. Ind. Occ. 3: 1837. 1806.

Plants yellowish green, laxly tufted; stems to 10 cm. or more long but usually shorter, variously branched, densely felted with

reddish brown tomentum below, branches in subfloral whorls on fertile stems. Leaves spreading from insertion, occasionally subsecund, 3–4 mm. long, narrowly lanceolate from an ovate base, slenderly acuminate; margins narrowly recurved below, distantly serrulate above; costa slender, excurrent; cells narrowly linear, incrassate, papillose above, smooth toward base, colored across insertion, very few at basal angles irregularly oblong, pellucid. Setae 1–2 cm. long; capsules nodding, ovoid, 3 mm. long. (Fig. 90, F–H.)

Dept. Alta Verapaz: *Standley 71074*. Dept. San Marcos: *Steyermark 35981, 36449a, 36799a; Standley 86194, 86205, 86296, 86400, 86469*. Dept. Totonicapan: *Standley 65919*. Dept. Quezaltenango: *Standley 67710*. Dept. Baja Verapaz: *Standley 69908*.

Distribution: Mexico, West Indies, Central and South America.

On wet banks at moderate to high altitudes. Variable but readily recognized by the spreading leaves with only a few differentiated cells at the extreme basal angles.

2. BREUTELIA SUBARCUATA (C. M.) Schp. in Besch., Prodr. Bryol. Mex. 60. 1871.

Bartramia subarcuata C. M., Syn. 2: 617. 1851.

Plants yellowish green; stems to 8 or 10 cm. long, copiously branched. Leaves crowded, spreading or often subfalcate, 4 mm. long, lanceolate from a short, broadly ovate, erect, slightly clasping, plicate base, margins recurved to or above mid-leaf, sharply serrulate above; costa excurrent; cells linear, sharply papillose, 4–5 rows at basal margins lax, oblong, pellucid, extending well up the basal margins. Setae 4–6 mm. long, curved, reddish; capsules subglobose, 3–3.5 mm. long, not furrowed. (Fig. 91, A–C.)

Dept. Huehuetenango: *Standley 83086b*. Dept. San Marcos: *Steyermark 35492* (c. fr.), *36099*. Dept. Quezaltenango: *Standley 67685a* (as *B. deflexifolia*), *67701* (as *B. deflexifolia*), *67744b* (as *B. deflexifolia*), *67749* (as *B. deflexifolia*), *67753* (as *B. deflexifolia*); *Steyermark 34163, 34854*. Dept. Chimaltenango: *Standley 61010* (as *B. deflexifolia*). Dept. Guatemala: *Standley 80699*. Dept. Jutiapa: *Steyermark 31922*.

Distribution: Mexico, Colombia.

On forested banks, trees and rocks at high altitudes. When in fruit the short, arcuate setae are distinctive. Sterile plants may be distinguished from *B. deflexifolia* by the more branched stems and the leaves often secund from a less strongly clasping base.

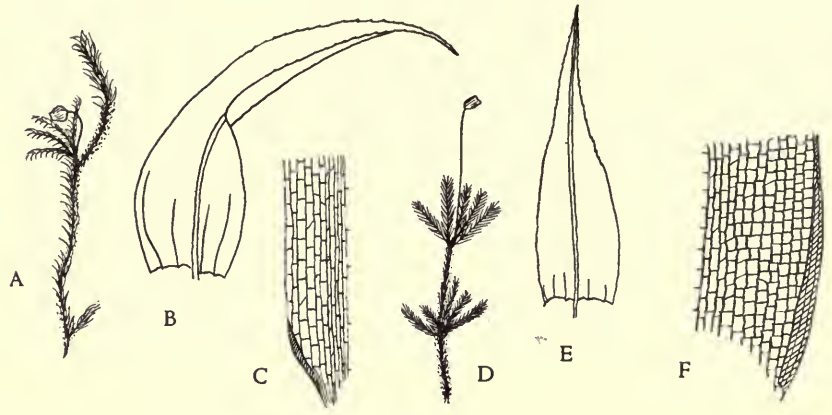

FIGURE 91

A–C, *Breutelia subarcuata:* A, plant, ×1; B, leaf, ×14; C, basal angle of leaf, ×120.

D–F, *Breutelia jamaicensis:* D, plant, ×1; E, leaf, ×14; F, basal angle of leaf, ×120.

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3. BREUTELIA JAMAICENSIS (Mitt.) Jaeg., Adumb. **1**: 558. 1873–74.

Bartramia jamaicensis Mitt., Journ. Linn. Soc. **12**: 265. 1869.

?Bartramia erythrocaulis C. M., Syn. **1**: 473. 1849.

Philonotis Schlumbergeri Schimp. in Besch., Prodr. Bryol. Mex. 59. 1871.

Philonotis haitensis Ren. & Card., Bull. Soc. Roy. Bot. Belg. **29**: 177. 1890.

Plants medium sized, yellowish or green, densely tufted; stems to 3 or 4 cm. high, densely tomentose below. Leaves closely imbricated, appressed when dry, 2–3 mm. long, ovate-lanceolate; margins recurved below, serrulate above; costa excurrent; upper cells linear, papillose, gradually shorter and broader below, basal cells subquadrate clear across the leaf. Seta about 1.5 cm. long, red; capsule ovoid, nodding, strongly furrowed, 2.5 mm. long. (Fig. 91, D–F.)

Dept. San Marcos: *Standley 68496, 86417, 86468; Steyermark 36493.* Dept. Totonicapan: *Standley 65924.* Dept. Quezaltenango: *Standley 66798, 67076, 83383, 84576, 84579, 84642, 84761, 86765.* Dept. Suchitepequez: *Steyermark 35320.* Dept. Chimaltenango: *Standley 61059.* Dept. Zacapa: *Steyermark 42204, 42207.* Dept. Chiquimula: *Steyermark 31123.* Dept. Jalapa: *Steyermark 32858.*

Distribution: Mexico, Costa Rica, Jamaica.

On damp banks, rocks and trees at medium to high altitudes. A variable plant but readily known by the large area of subquadrate cells extending across the leaf base.

4. BREUTELIA AURICULATA Bartr., Bryol. **49**: 115. 1946.

Robust plants, green above, brown below; stems 10–12 cm. long, densely reddish tomentose below. Leaves erect-spreading, somewhat flexuous when dry, 4 mm. long, oblong-lanceolate, gradually slenderly acuminate, faintly plicate at base, with conspicuous, laxly areolate, decurrent auricles; margins plane, minutely serrulate nearly to base; costa percurrent; cells narrowly linear, sharply papillose at upper ends, very lax, smooth, hyaline or brownish at extreme base, laxly rectangular and hyaline in the decurrent auricles. Setae 12–14 mm. long, flexuous, reddish; capsules subglobose, inclined, sulcate. (Fig. 92, A–C.)

Dept. San Marcos: Finca El Porvenir along Rio Chopal, south-facing slopes of Volcan Tajumulco, alt. 1,300–1,500 m., *Steyermark 37462* TYPE.

Endemic.

Sharply distinct from any other species of the genus familiar to me in the lax basal cells and the laxly areolate, hyaline, decurrent auricles.

5. BREUTELIA BRITTONIAE Ren. & Card., Bull. Soc. Bot. Belg. **31**: 161. 1893.

Stems slender, branched, to 10 cm. long, densely reddish tomentose below. Leaves crowded, 3–4 mm. long, plicate, abruptly lanceo-

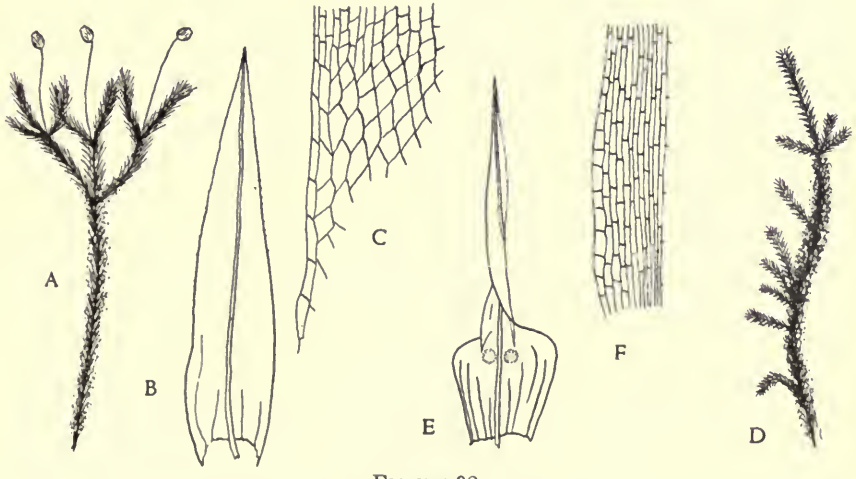

FIGURE 92

A–C, *Breutelia auriculata:* A, plant, ×1; B, leaf, ×14; C, basal angle of leaf, ×120.

D–F, *Breutelia Brittoniae:* D, part of plant, ×1; E, leaf, ×14; F, basal angle of leaf, ×120.

late from a short, erect, sulcate, closely clasping, obovate base, acuminate, points squarrose-spreading, often with a small pocket of lax cells on each side of the costa near the top of the leaf base; margins slightly recurved at leaf shoulders, otherwise plane, serrulate above; costa excurrent; cells linear, papillose above, smooth at base, several rows at basal margins more lax, oblong and pellucid. Setae 1.5 cm. long, erect; capsules nodding, ovoid, 3 mm. long, furrowed. (Fig. 92, D–F.)

Dept. Huehuetenango: *Steyermark 50072*. Dept. San Marcos: *Steyermark 35790, 35982*. Dept. Totonicapan: *Standley 62731, 62734*. Dept. Chimaltenango: *Standley 61084a*.

Distribution: Costa Rica, Colombia.

On banks and trees at high altitudes. The characteristic little pockets or cavities of lax cells are not always evident but occur at least in some leaves of every plant examined. The slender habit and short leaf base, broader at the shoulders than below will separate it from *B. deflexifolia*.

6. BREUTELIA DEFLEXIFOLIA Card., Rev. Bryol. **37**: 4. 1910.

Stems to 10 cm. long, sparingly branched, densely tomentose below. Leaves crowded, deflexed or widely spreading, 5–6 mm. long, lanceolate from an erect, ovate, lightly plicate base, slenderly acuminate; margins recurved to about mid-leaf, serrulate above; cells narrowly linear, incrassate, papillose 5–6 rows at basal margins rectangular, lax and hyaline, forming a border nearly to the leaf shoulders. Seta erect, 7 mm. long, red, stout, curved at tip; capsule pendulous, subglobose, nearly smooth; lid conical (Fig. 93, A–C.)

Dept. Huehuetenango: *Steyermark 50173a* (c. fr.). Dept. El Progresso: *Steyermark 43094*.

Distribution: Mexico.

Terrestrial at high altitudes. More robust than *B. Brittoniae*, the leaves larger and the margins strongly recurved below.

21. ERPODIACEAE

Autoicous; small, delicate, soft plants, usually corticolous, growing in mats. Stems lax in structure, prostrate, branched, usually flattened. Leaves crowded, broad, ecostate, unbordered; cells rounded-hexagonal, smooth or papillose. Sporophyte at ends of short lateral branches; seta short, erect; capsule erect, thin walled, persistent; peristome lacking or simple; calyptra mitriform, plicate.

1. ERPODIUM (Brid.) C. M., Bot. Zeit. **1**: 774. 1843.

Anoectangium subg. *Erpodium* Brid., Bryol. Univ. **2**: 167. 1827.

Plants with the characters of the family. Leaves imbricated, concave; cells rounded, smooth or papillose. Perichaetial leaves erect; seta short; capsules erect, exserted (in our species); annulus broad; lid nearly flat; peristome lacking; calyptra mitriform, plicate, lobed at base.

Leaf apex acuminate, cells smooth ..... 2. *E. Pringlei*
Leaf apex rounded, cells papillose ..... 1. *E. domingense*

1. ERPODIUM DOMINGENSE (Brid.) C. M., Bot. Zeit. **1**: 774. 1843.

Anoectangium Erpodium domingense Brid., Bryol. Univ. **2**: 167. 1827.

Plants yellowish green in close mats; stems flattened, to 1.5 mm. wide with leaves, radiculose. Leaves closely imbricated when dry, oblong-lingulate, to 1 mm. long, entire, rounded at apex; cells large, papillose, rather obscure. Seta less than 0.5 mm. long; capsule exserted, cylindrical, pale, 1 mm. long; lid plano-convex; calyptra plicate, scabrous on the plaits, lobed at base, fugacious; spores 25–30 μ. (Fig. 93, D–F.)

Distribution: Texas, Mexico, West Indies.

Usually on trees. This well known tropical American species is recorded by Steere from the department of Peten (*Lundell 2325*) but I have seen no collection from the local area.

2. ERPODIUM PRINGLEI E. G. Britt., Bull. Torr. Bot. Club **32**: 266. 1905.

Plants tinged with brown; stems creeping, radiculose, closely applied to the substratum, branches numerous, short, blunt, subterete. Leaves closely imbricated, 1–1.3 mm. long, broadly ovate, concave, short acuminate, entire; cells rounded-hexagonal, about 20 μ, smooth, distinct, becoming wider than long below mid-leaf and smaller at margins. Perichaetial leaves erect, clasping; capsule partly exserted, urn 1 mm. long; spores 25–35 μ. (Fig. 93, G–I.)

Dept. Santa Rosa: *Standley 79427*.

Distribution: Mexico.

On exposed rock at low altitude. The collection is sterile and the habit on rock unusual but otherwise the plants are indistinguishable from the corticolous specimens from Mexico.

22. ORTHOTRICHACEAE

Plants growing on rocks or trees in tufts or mats. Stems erect or creeping with erect branches. Leaves crowded, hygroscopic, lanceolate; costa strong, usually percurrent; upper cells rounded, usually papillose, elongate below. Seta terminal; capsules immersed or exserted, smooth or plicate; peristome usually present and double, the teeth often united in pairs, segments of endostome narrow; lid generally beaked; calyptra mostly mitriform or campanulate, smooth or plicate, usually pilose.

1. Stems erect 2
   Stems creeping, often with erect branches 3
2. Calyptra small, cucullate ..... 1. *Zygodon*
   Calyptra large, campanulate ..... 2. *Orthotrichum*
3. Leaves long decurrent, spinose-tuberculate at basal angles, basal cells short ..... 3. *Coleochaetium*
   Leaves not as above 4
4. Calyptra large, campanulate, not plicate, lobed at base ..... 6. *Schlotheimia*
   Calyptra mitriform, usually plicate, laciniate at base 5
5. Leaves bordered below with several rows of elongated cells, basal cells short ..... 5. *Micromitrium*
   Leaf base not bordered, basal cells usually elongate ..... 4. *Macromitrium*

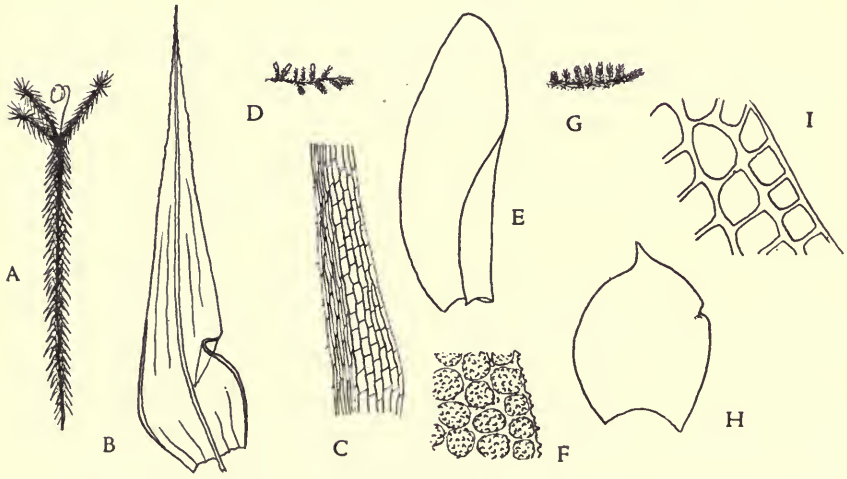

FIGURE 93

A–C, *Breutelia deflexifolia:* A, part of plant, ×1; B, leaf, ×12; C, basal angle of leaf, ×120.

D–F, *Erpodium domingense:* D, plant, ×1; E, leaf, ×54; F, upper leaf cells and margin, ×270.

G–I, *Erpodium Pringlei:* G, plant, ×1; H, leaf, ×30; I, upper leaf cells and margin, ×270.

1. ZYGODON Hook. & Tayl., Musc. Brit. 70. 1818.

Slender, tufted plants; stems erect, dichotomously branched. Leaves lanceolate, contorted when dry, entire or serrate above; costa strong; upper cells small, rounded, incrassate. Seta terminal, elongate; capsules suberect, 8 ribbed; peristome single, double or none; calyptra cucullate, fugacious.

1. Leaf apex rounded ..... 1. *Z. obtusifolius*
   Leaf apex acuminate 2
2. Leaves strongly squarrose-recurved when moist ..... 3. *Z. campylophyllus*
   Leaves erect-spreading when moist ..... 2. *Z. Reinwardtii*

1. ZYGODON OBTUSIFOLIUS Hook., Musc. Exot., tab. 159. 1819.

Zygodon spathulaefolius Besch., Prodr. Bryol. Mex. 43. 1871.

Autoicous; plants small, in compact reddish brown tufts; stems 6–12 mm. high, branched, densely reddish tomentose below. Leaves lingulate, broadly rounded, to 1 mm. long; margins papillose-crenulate, recurved below; costa ending below apex, scabrous on back; cells small, rounded-quadrate, incrassate, coarsely papillose. Seta 4–5 mm. long; capsule erect or slightly inclined, cylindrical, strongly ribbed, urn 1.25 mm. long; peristome double, teeth blunt, in 8 pairs, segments 8, as long as teeth. (Fig. 94, A–C.)

Dept. Baja Verapaz: *O. F. Cook & C. B. Doyle 255.*

Distribution: Mexico, South America, New Zealand, Asia.

A highly individual species clearly distinguished by the broadly rounded lingulate leaves with the costa ending well below the apex.

2. ZYGODON REINWARDTII (Hornsch.) Al. Br., Bry. Eur. 4, mon. 9. 1838.

Syrrhopodon Reinwardtii Hornsch., Nov. Act. Acad. Leop. 14^2: 700.

Zygodon circinatus Schimp. in Besch., Prodr. Bryol. Mex. 43. 1871.

Synoicous or heteroicous; tufts dense, yellowish green; stems about 2 cm. high, tomentose below. Leaves crispate when dry, to 1.5 mm. long, oblong-lanceolate, short acuminate, carinate, decurrent; margins erect, coarsely and irregularly serrate near apex; costa ending in or near apex; basal cells rectangular, upper cells rounded, incrassate, papillose. Seta 1–2 cm. high; capsule nearly cylindrical, small mouthed; peristome single, teeth 16, short and often rudimentary; spores 20–25 μ. (Fig. 94, D–F.)

Dept. Huehuetenango: *Standley 81124* in part. Dept. El Progresso: *Steyermark 43119.* Dept. Jalapa: *Steyermark 32758a.*

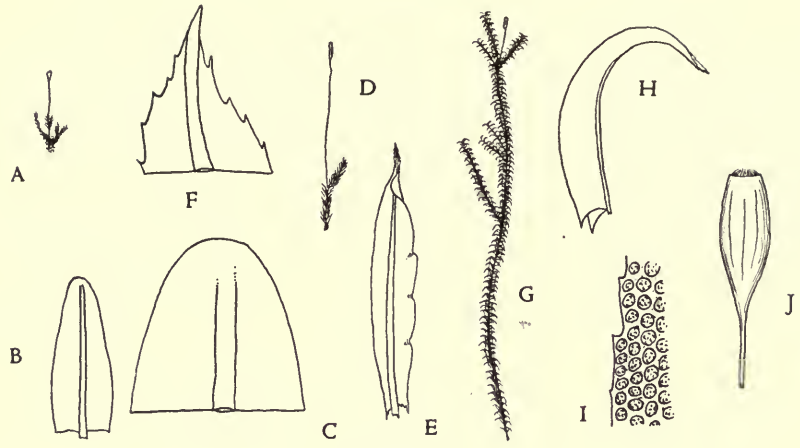

FIGURE 94

A–C, *Zygodon obtusifolius:* A, plant, ×1; B, leaf, ×26; C, apex of leaf, ×120. D–F, *Zygodon Reinwardtii:* D, plant, ×1; E, leaf, ×26; F, apex of leaf, ×120. G–J, *Zygodon campylophyllus:* G, moist plant, ×1; H, leaf, ×16; I, upper leaf cells and margin, ×270; J, capsule, ×8.

Distribution: Alaska, Mexico, Costa Rica, West Indies, South America, Pacific Islands, India, Africa.

On trees and banks at medium to high altitudes. The sharply toothed apical leaf margins can usually be relied upon as a good diagnostic character for the typical form but the var. *subintegrifolius* is not without difficulties. Fruiting plants in good condition are essential for accurate determination in many of the species.

var. SUBINTEGRIFOLIUS Malta, Monog. 122. 1926.

Leaves entire or nearly so.

Dept. San Marcos: *Standley 85285.* Dept. Totonicapan: *Standley 84534a.* Dept. Quezaltenango: *Steyermark 34914b.*

Distribution: South America.

These collections all lack good fruit. I had determined them as *Z. Liebmannii* Schimp. on account of the subentire leaves, but Dr. Grout, who has kindly examined them in the course of his studies in this group, thinks that they might better be referred here.

3. ZYGODON CAMPYLOPHYLLUS C. M., Syn. **1**: 680. 1849.

Dioicous; stems slender, to 10 cm. high, branched, tomentose below. Leaves erect and slightly contorted when dry, squarrose-

recurved when moist, 2 mm. long, lanceolate, decurrent, carinate; margins often slightly reflexed above, sharply serrate toward apex; costa ending below apex; upper cells small, rounded or angular, incrassate, papillose, rectangular and smooth below. Seta 5–6 mm. long; capsule cylindric, 2.5 mm. long; peristome double, teeth broad and blunt, in 8 pairs, segments 8, narrow; lid slenderly beaked, curved. (Fig. 94, G–J.)

Dept. Huehuetenango: *Standley 81621a, 81732, 81743, 81749, 81801, 83088* (c. fr.), *83089* (c. fr.); *Steyermark 48374*. Dept. Totonicapan: *Standley 84521b*. Dept. Chimaltenango: *Standley 58781a*.

Distribution: Mexico.

On trees and shaded limestone rocks in alpine regions. The long, slender, much branched stems with the leaves squarrose-recurved when moist will identify this individual species with little difficulty. It will almost surely be mistaken for a Leptodontium at first glance. A pertinent query is how this species differs from *Z. gracilis* Wils.

2. ORTHOTRICHUM Hedw., Sp. Musc. 162. 1801.

Plants tufted, growing on trees or rocks; stems erect. Leaves hygroscopic, imbricated, lanceolate, mostly entire; costa strong; upper cells small, incrassate, papillose, rectangular below. Seta terminal, short; capsules immersed or emergent, often 8 ribbed; peristome usually double, teeth 16, often in pairs, segments 8 or 16, narrow; calyptra campanulate, plicate, often pilose.

1. Stomata superficial ..... 1. *O. pycnophyllum*
   Stomata immersed 2
2. Capsules exserted, rupestrine plants ..... 2. *O. anomalum*
   Capsules immersed or emergent, corticolous plants 3
3. Upper and perichaetial leaves toothed ..... 3. *O. Bartramii*
   Leaves entire ..... 4. *O. malacophyllum*

1. ORTHOTRICHUM PYCNOPHYLLUM Schimp. in C. M., Syn. 1: 709. 1849.

Orthotrichum recurvans Schimp. in C. M., Syn. 1: 709. 1849.
Orthotrichum Lozani Card., Rev. Bryol. 36: 107. 1909.

Autoicous; plants to 3 or 4 cm. high. Leaves ovate-lanceolate, 3–4 mm. long, acuminate; costa percurrent; margins recurved to just below apex; upper cells rounded, incrassate, papillose, basal

cells linear, nodulose, shorter and broader toward margins. Seta variable, to 2.5 mm. long; capsules immersed or exserted, nearly smooth or lightly ribbed in upper half, ovoid-cylindric, sulcate when dry and empty, stomata superficial, near middle of urn; peristome teeth in 8 pairs, papillose, segments 16, about as long as teeth, 2 cells wide, papillose; spores 16–20 μ. (Fig. 96, A–C.)

Dept. Totonicapan: *Standley 62666a.*

Distribution: Mexico.

On tree at high altitude. Very near *O. speciosum* Nees. The only noticeable difference is in the segments of the endostome which in *O. pycnophyllum* are supposed to number 16 but in some capsules I find only 8.

2. ORTHOTRICHUM ANOMALUM Hedw., Sp. Musc. 162. 1801.

Autoicous; densely tufted, dark green rupestrine plants. Stems 1 cm. or more high, simple or branched. Leaves imbricated when dry, strongly hygroscopic, to 3 mm. long, oblong-lanceolate, broadly acute; margins revolute, entire; costa brown, ending just below apex; upper cells irregularly rounded, incrassate, papillose, basal cells rectangular, thin-walled, smooth. Seta 1.5 mm. long; capsules exserted, ovoid-cylindric, tapering below, urn 2 mm. long, stomata immersed; peristome double, teeth erect when dry, faintly striolate, segments of endostome rudimentary and fragile; calyptra pilose. (Fig. 95, A–C.)

Dept. Huehuetenango: *Sharp 5000a.*

Distribution: Northern United States and Canada south to New Mexico.

On limestone boulder at high altitude. A significant collection marking another long range extension to the south. These plants are associated with *Grimmia apocarpa* var. *gracilis* just as they might be in northeastern United States.

3. ORTHOTRICHUM BARTRAMII Williams, Bryol. **28**: 76. 1925.

Mostly autoicous; small compactly tufted plants, yellowish green at tips, brown below. Stems to 1 cm. high, often branched. Leaves appressed when dry, widely spreading when moist, about 2 mm. long, oblong-ovate, pinched at apex to a short, blunt, toothed point; margins recurved nearly to apex; costa ending below apex; upper cells rounded, incrassate, papillose, basal cells rectangular near

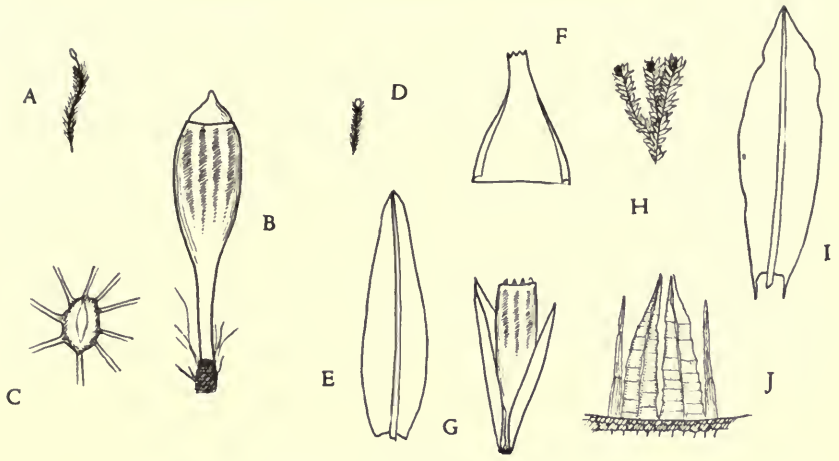

FIGURE 95

A–C, *Orthotrichum anomalum:* A, plant, ×1; B, capsule, ×8; C, stoma of capsule, ×270.

D–G, *Orthotrichum Bartramii:* D, plant, ×1; E, leaf, ×16; F, apex of leaf, ×68; G, sporophyte, ×10.

H–J, *Orthotrichum malacophyllum* var. *guatemalense:* H, plant, ×1; I, leaf, ×12; J, part of peristome, ×68.

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costa, subquadrate toward margins. Seta scarcely 1 mm. long; capsules emergent, ovoid, urn to 1.5 mm. long, ribbed, stomata immersed; peristome double, teeth papillose, paired, segments of endostome 8; calyptra pilose. (Fig. 95, D–G.)

Dept. Quezaltenango: *Sharp 2317.*

Distribution: Arizona.

On tree trunk at moderately high altitude. An interesting range extension of this species hitherto known only from the type locality in Arizona. The Guatemalan plants are not exactly typical but the toothed upper leaves suggest this species rather than *O. tenellum* Bruch.

4. ORTHOTRICHUM MALACOPHYLLUM Card. var. GUATEMALENSE Bartr., Bryol. **50**: 207. 1947.

Autoicous; small dull yellowish plants tinged with brown, densely tufted. Stems to 1 cm. high, branched. Leaves contorted when dry, spreading when moist, to 3 mm. long, narrowly oblong-lanceolate, bluntly acute, carinate, decurrent; margins entire, recurved below; costa ending below apex; upper cells rounded, incrassate, minutely

papillose, basal cells rectangular with firm, pellucid, sinuose lateral walls. Seta very short; capsules immersed, oblong, urn 2 mm. long, stomata immersed; peristome teeth paired, minutely papillose, segments of endostome 8, vertically striolate; calyptra pilose. (Fig. 95, H–J.)

Dept. El Quiche: *Sharp 2432, 2445, 2463*. Dept. Baja Verapaz: *Sharp 2926a*.

Endemic.

On trees and shrubs at moderate altitudes. These collections are an exact counterpart of the Mexican species except that the segments of the endostome are uniformly vertically striolate instead of papillose.

3. COLEOCHAETIUM (Besch.) Ren. & Card., Bull. Soc. Bot. Belg. **33**[2]: 120. 1894.

Orthotrichum subg. *Coleochaetium* Besch., Fl. Bryol. Reun. **1879**: 66. 1879.

Medium sized brownish green plants in lax, intricate tufts; stems creeping, branched. Leaves crowded, fragile, decurrent; costa strong; cells uniform, rounded, small, papillose and pellucid, rectangular and spinose in the decurrent portion. Seta short, erect; capsules exserted, 8 ribbed; peristome double; calyptra campanulate, smooth, pilose (sporophyte not seen).

1. COLEOCHAETIUM STANDLEYI Bartr., Bryol. **47**: 21. 1944.

Probably dioicous. Plants wiry, laxly caespitose, dull sordid green, brown below. Primary stems creeping, radiculose, irregularly branched, branches up to 5 cm. long, laxly and irregularly rebranched, branches obtuse or often attenuate and radiculose at the tips, flexuous when moist, variously curved and contorted when dry. Leaves crowded, 5 ranked, appressed when dry, squarrose-spreading when moist, about 2 mm. long, 1 mm. wide, shortly ligulate-lanceolate from an ovate base, carinate above with the points fragile and usually broken off, acute, apiculate, strongly decurrent; margins narrowly recurved below, sharply and finely papillose-serrate above; costa brownish, strong, ending below apex; leaf cells obscure, densely papillose with sharp, salient papillae, rounded, about 10 μ in diameter, in the decurrent angles large, rectangular and pellucid, strongly armed with high, spine-like tubercles up to 20 μ long. Fruit unknown. (Fig. 96, D–G.)

Dept. Huehuetenango: Rio Pucal, about 14 km. south of Huehuetenango, alt. about 1,780 m., *Standley 82293*.

Endemic.

In this highly individual species the decurrent leaf auricles composed of large, rectangular, pellucid cells strongly armed with spinose tubercles is a striking character. The species is evidently near *C. scaberrimum* (Broth.) Broth. of Brazil but the plants are wiry, laxly branched and strongly contorted when dry whereas the Brazilian plants are described as rigid, densely branched with strict branchlets. No specimen of *C. scaberrimum* is available for comparison but it seems evident that the Guatemalan plant is distinct. It is a privilege to associate Dr. Standley's name with this unique addition to the Central American moss flora.

4. MACROMITRIUM Brid., Musc. Rec. Suppl. **4**: 132. 1819.

Plants slender to robust, in dense mats; stems elongate, creeping, branches numerous, erect, densely foliate. Leaves lanceolate or oblong; costa strong; upper cells small, smooth or papillose, basal cells, usually elongated. Seta smooth or scabrous; capsules exserted, erect, ovoid, smooth or ribbed; peristome single, double or lacking; calyptra large, mitriform, naked or pilose, deeply laciniate below; lid mostly long beaked.

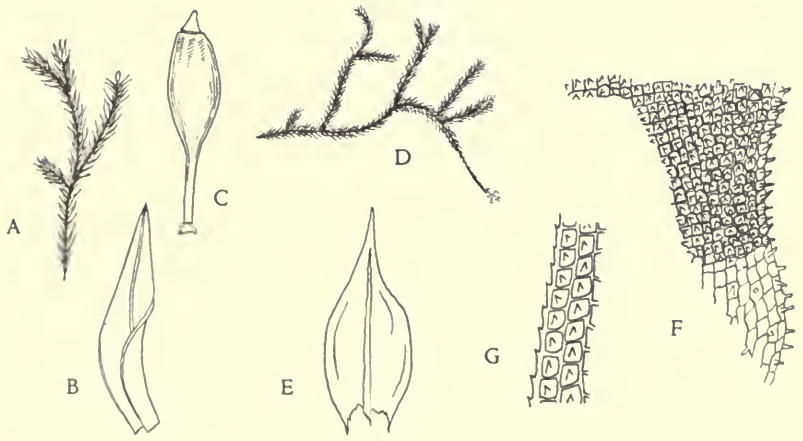

FIGURE 96

A–C, *Orthotrichum pycnophyllum:* A, plant, ×1; B, leaf, ×8; C, capsule, ×8. D–G, *Coleochaetium Standleyi:* D, part of moist plant, ×1; E, leaf, ×14; F, basal angle of leaf, ×120; G, upper leaf cells and margin, ×270.

Grout's timely and important studies in this group (Grout 18) have been followed closely in the treatment of the local species.

1. Stems slender, leaves rigid and appressed when dry, basal cells short.....2
   Stems more robust, leaves spreading, basal cells elongate.....3
2. Calyptra pilose, peristome a rudimentary membrane....1. *M. hymenostomum*
   Calyptra naked or nearly so, peristome of 16 short teeth.....2. *M. filiforme*
3. Capsule mouth small, puckered or plicate.....4
   Capsule mouth wide, not puckered.....5
4. Leaves lanceolate, acuminate, cells incrassate.....3. *M. stratosum*
   Leaves lingulate, short pointed, cells thin-walled.....4. *M. Richardi*
5. Capsules ribbed.....6
   Capsules smooth.....12
6. Seta scabrous.....7
   Seta smooth.....8
7. Calyptra pilose, peristome teeth long, subulate-acuminate..7. *M. homalacron*
   Calyptra naked, peristome teeth short, truncate.....6. *M. longifolium*
8. Leaves lingulate, obtuse, mucronate.....5. *M. altituberculosum*
   Leaves lanceolate, acute.....9
9. Leaves entire.....11. *M. Podocarpi*
   Leaves toothed above.....10
10. Leaf cells highly convex or mammillose.....9. *M. serrulatum*
    Leaf cells smooth or slightly convex.....11
11. Seta 8–10 mm. long, leaves squarrose-recurved when moist.8. *M. punctatum*
    Seta 4–5 mm. long, leaves erect-spreading.....10. *M. guatemalense*
12. Calyptra pilose, leaves spirally ranked.....12. *M. pentastichum*
    Calyptra naked, leaves not seriate.....13
13. Leaves ending in a long, fragile point, mostly broken off at base of acumen
    14. *M. fragilicuspis*
    Leaves acuminate, not fragile.....13. *M. cirrosum*

1. MACROMITRIUM HYMENOSTOMUM Mont., Ann. Sci. Nat. 3, 4: 120. 1845.

Macromitrium mexicanum Mitt., Journ. Linn. Soc. **12**: 198. 1869.

Very slender plants in thin mats, brown below, yellowish green at tips. Branches suberect, to 2 cm. long. Leaves closely imbricated when dry, 1–1.5 mm. long, narrowly triangular-lanceolate, acuminate, carinate, excavate at base; margins entire, slightly recurved near base; cells nearly uniform throughout, oval, incrassate, nearly smooth above, mammillose near base. Seta 8–10 mm. long, smooth; capsule ovoid-cylindric, puckered at mouth, 2 mm. long; peristome

single, a low, coarsely papillose cylinder representing the endostome; calyptra brown, pilose, covering capsule. (Fig. 97, A–C.)

Dept. Guatemala: *Standley 80555.*

Distribution: Georgia, Mexico, Costa Rica, South America.

On tree at moderate altitude. The slender, subjulaceous branches with rigidly erect leaves are very characteristic. *M. filiforme* (Hook. & Grev.) Schwaegr. is quite similar but has less slenderly pointed leaves, less incrassate upper cells and a different peristome.

2. MACROMITRIUM FILIFORME (Hook. & Grev.) Schwaegr., Suppl. 2^2: 64. 1826.

Orthotrichum filiforme Hook. & Grev., Edinb. Journ. Sci. 1: 116. 1824.

Slender plants scarcely distinguishable from *M. hymenostomum* except in the sporophyte characters. Capsules noticeably plicate; peristome single, of 16 short, papillose teeth; calyptra naked or very sparsely pilose; spores brownish, papillose, diameter to 50 μ. (Fig. 98, A–C.)

Dept. Quezaltenango: *Sharp 1955, 2051.*

Distribution: Mexico, Central America, South America.

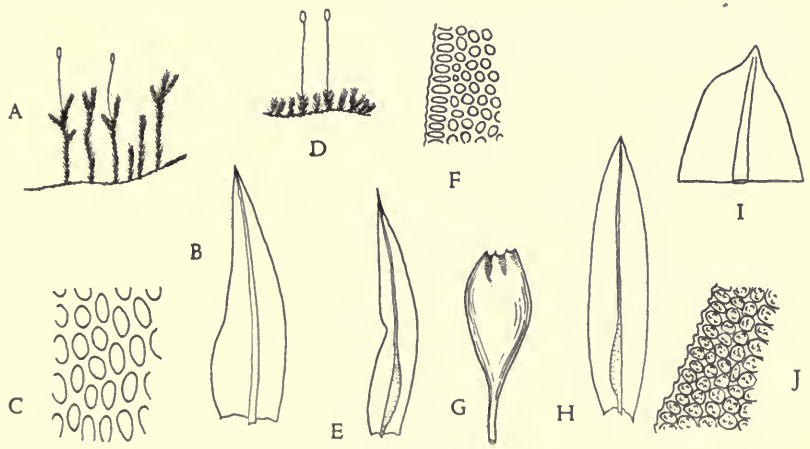

FIGURE 97

A–C, *Macromitrium hymenostomum:* A, part of plant, ×1; B, leaf, ×22; C, basal leaf cells, ×270.

D–G, *Macromitrium stratosum:* D, plant, ×1; E, leaf, ×22; F, upper leaf cells and margin, ×270; G, capsule, ×8.

H–J, *Macromitrium Richardi:* H, leaf, ×22; I, apex of leaf, ×120; J, upper leaf cells and margin, ×270.

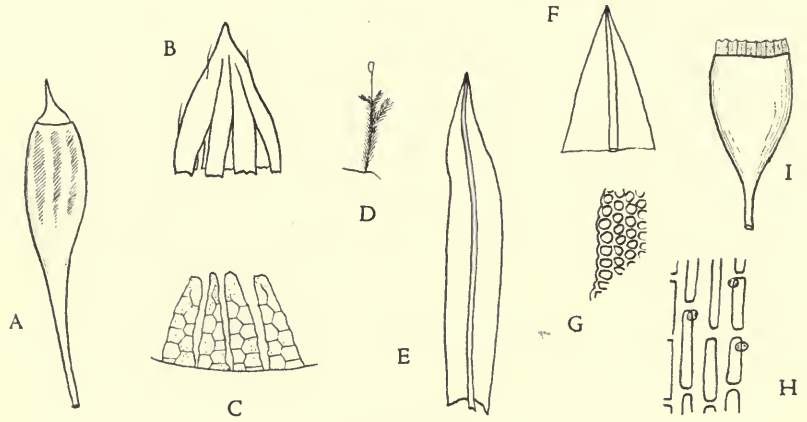

FIGURE 98

A–C, *Macromitrium filiforme:* A, capsule, ×10; B, calyptra, ×10; C, part of peristome, ×68.

D–I, *Macromitrium Podocarpi:* D, plant, ×1; E, leaf, ×24; F, apex of leaf, ×134; G, upper leaf cells and margin, ×338; H, basal leaf cells, ×338; I, capsule, ×12.

On trees at moderately high altitudes. These collections are well within the range of the species in North America but are the only records from Guatemala that I know of. The sparsely pilose calyptrae and well developed peristome teeth will readily separate it from *M. hymenostomum* Mont.

3. MACROMITRIUM STRATOSUM Mitt., Journ. Linn. Soc. **12:** 199. 1869.

Autoicous; plants brownish green; branches numerous, less than 1 cm. long. Leaves crowded, erect with incurved, crispate points when dry, about 1.5 mm. long, ovate-lanceolate, acuminate; margins minutely crenulate above; costa percurrent; upper cells rounded, smooth, very incrassate, basal cells linear, smooth. Seta smooth, 10–15 mm. long; capsule ovoid, 1.5 mm. long, puckered around the small mouth; peristome single, of 16 papillose teeth; calyptra naked. (Fig. 97, D–G.)

Dept. Alta Verapaz: *Standley 92406* (as *M. didymodon*).

Distribution: Costa Rica, West Indies.

On tree at moderate altitude. The thick walled upper leaf cells and the narrower basal cells are distinguishing characters in comparison with *M. Richardi* as are also the sharper leaf points and naked calyptrae.

4. MACROMITRIUM RICHARDI Schwaegr., Suppl. 2^2: 70. 1826.

Macromitrium Didymodon Schwaegr., Suppl. 2^2: 138. 1827.

Autoicous; plants yellowish green; branches 1–1.5 cm. high. Leaves erect with inrolled points when dry, 2–2.5 mm. long, narrowly lanceolate, broadly acute; margins papillose-crenulate above, recurved on one side below; costa ending in or below apex; upper cells small, rounded, papillose obscure, not incrassate, gradually more elongate, smooth and incrassate toward base. Seta 8–10 mm. long; capsule ovoid, ribbed, puckered and colored around the small mouth; peristome single, of 16 short, pale, papillose, paired teeth; calyptra sparingly pilose. (Fig. 97, H–J.)

Dept. Alta Verapaz: *Standley 69103*.

Distribution: Florida, Mexico, West Indies, Central and South America.

On tree at moderate altitude. This and the preceding species are the only local representatives of the Sec. Goniostoma characterized by capsules with a small, fleshy, highly colored, puckered mouth.

5. MACROMITRIUM ALTITUBERCULOSUM Bartr., Bryol. **47**: 17. 1944.

Rather robust plants in wide mats, dull olive green, brown below; branches crowded, about 1 cm. high, obtuse, densely foliate, reddish tomentose below. Leaves appressed and spirally contorted when dry, spreading when moist, about 2 mm. long, 0.8 mm. wide, lingulate, concave, plicate, obtuse, short mucronate, decurrent; margins erect, crenulate above, tuberculate toothed toward insertion; costa strong, short excurrent; upper leaf cells rounded-hexagonal, not incrassate, 6–8 μ in diameter, basal cells narrowly rectangular, strongly tuberculate, at the decurrent basal angles densely armed with long, spine-like tubercles. Perichaetial leaves similar but acute with the costa percurrent; seta stout, 6 mm. long, smooth; capsule ovoid, urn 2 mm. long, strongly ribbed when dry; peristome simple, teeth to 240 μ long, densely and minutely papillose; calyptra naked, scabrous above, 3.5 mm. long; operculum 1–1.2 mm. long, conic-rostrate; spores papillose, to 30 μ in diameter. (Fig. 99, A–D.)

Dept. Zacapa: Sierra de las Minas, oak-pine woods along the upper reaches of Rio Sitio Nuevo, between Santa Rosalia and first waterfall, alt. 1,200–1,500 m., on rock, *Steyermark 42274*.

Endemic.

A striking feature of this unusual species is the dense armature of long, spine-like tubercles at the basal angles of the leaves. I know

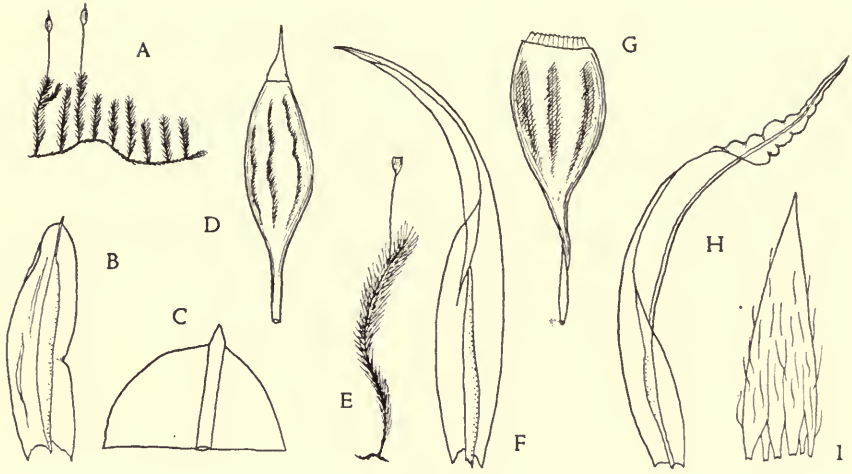

FIGURE 99

A–D, *Macromitrium altituberculosum:* A, plant, ×1; B, leaf, ×16; C, apex of leaf, ×120; D, capsule, ×8.

E–G, *Macromitrium longifolium:* E, plant, ×1; F, leaf, ×14; G, capsule, ×8.

H–I, *Macromitrium homalacron:* H, leaf, ×14; I, calyptra, ×8.

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of no other species with which it might be compared. The lingulate leaves, rounded and mucronate at the apex, along with the ribbed capsules distinguish it at once from any of the other Guatemalan species.

6. MACROMITRIUM LONGIFOLIUM (Hook.) Brid., Bryol. Univ. **1**: 738. 1826.

Orthotrichum longifolium Hook., Musc. Exot. tab. 44. 1818.

Rather robust, tawny plants, densely tufted; branches crowded, densely foliate, to 2.5 cm. high. Leaves spirally contorted and flexuous when dry, 4–5 mm. long, narrowly lanceolate, slenderly acuminate, slightly undulate above, serrulate toward apex; costa ending in or near apex; upper cells irregularly rounded, incrassate, smooth, longer in acumen and gradually elongate below, basal cells linear, strongly tuberculate. Seta 8–16 mm. long, scabrous above or throughout; capsule oblong, ribbed, 2 mm. long; peristome double, teeth close, short, truncate, united below; lid long beaked; calyptra naked. (Fig. 99, E–G.)

Dept. San Marcos: *Standley 68489, 68517.* Dept. Chimaltenango: *Standley 58753, 61080a, 61087a.*

Distribution: Mexico, Costa Rica, West Indies, South America, Galapagos Islands.

On trees and damp banks at rather high altitudes. The combination of rough setae, ribbed capsules and naked calyptrae make the identification of this species relatively easy.

7. MACROMITRIUM HOMALACRON C. M., Bull. Herb. Boiss. **5**: 197. 1897.

Macromitrium perundulatum Bartr. in herbaria.

Plants similar in size and appearance to *M. longifolium*. Leaves often distinctly undulate when dry. Seta about 5 mm. long, scabrous; capsule oblong, ribbed; peristome teeth with fragile, acuminate points; calyptra pilose. (Fig. 99, H–I.)

Dept. Huehuetenango: *Steyermark 51966.* Dept. San Marcos: *Steyermark 35788.* Dept. Quezaltenango: *Steyermark 34880.* Dept. Jalapa: *Steyermark 32758.*

Distribution: Haiti.

On trees and humus at high altitudes. Although near *M. longifolium* this species may be distinguished by the shorter setae and pilose calyptrae.

8. MACROMITRIUM PUNCTATUM (Hook. & Grev.) Brid., Bryol. Univ. **1**: 739. 1826.

Orthotrichum punctatum Hook. & Grev., Edinb. Journ. Sci. **1**: 119. 1824.

Macromitrium Sumichrasti Duby, Mem. Soc. Hist. Nat. Genéve **19**: 297. 1867–68.

Macromitrium reflexifolium Mitt., Journ. Linn. Soc. **12**: 211. 1869.

Branches numerous, to 1.5 cm. high, densely foliate. Leaves erect and flexuous when dry, squarrose-recurved when moist, oblong-lanceolate, broadly acute to apiculate, 2–2.5 mm. long, serrate toward apex; costa percurrent or short excurrent; upper cells small, rounded, papillose, basal cells linear, tuberculose. Seta 8–12 mm. long, smooth; capsule ovoid, ribbed, 1.5 mm. long; peristome double, teeth united in a low cylinder; calyptra naked. (Fig. 100, A–C.)

Dept. Alta Verapaz: *Standley 89858; Steyermark 45676.*

Distribution: Mexico, Costa Rica, Panama, West Indies, South America.

On trees and rocks at moderate altitudes. The relatively long setae and the leaves decurved when moist are fairly good diagnostic characters in comparison with *M. guatemalense*.

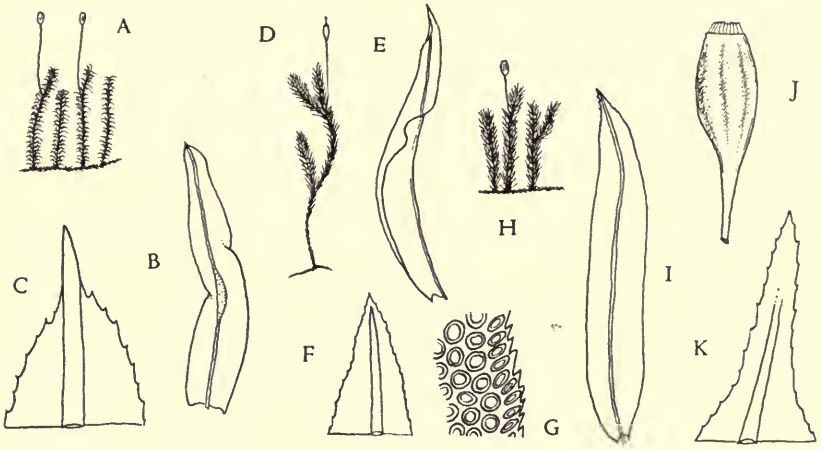

FIGURE 100

A–C, *Macromitrium punctatum:* A, plant, ×1; B, leaf, ×16; C, apex of leaf, ×120.

D–G, *Macromitrium serrulatum:* D, plant, ×1; E, leaf, ×16; F, apex of leaf, ×120; G, upper leaf cells and margin, ×270.

H–K, *Macromitrium guatemalense:* H, plant, ×1; I, leaf, ×16; J, capsule, ×8; K, apex of leaf, ×120.

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9. MACROMITRIUM SERRULATUM Mitt., Journ. Linn. Soc. **12**: 215. 1869.

Macromitrium verrucosum Bartr., Contr. U. S. Nat. Herb. **26**[3]: 82. 1928.

Branches 3–4 cm. high, brownish and radiculose below, yellowish green above. Leaves 2.5–3 mm. long, oblong-lanceolate, acute, carinate, crisped when dry, squarrose-spreading when moist; margins undulate and serrulate about ⅓ down; costa ending just below apex; upper cells rounded, about 12 μ, strongly mammillose on both surfaces, narrowly linear and tuberculose below. Seta about 1 cm. long, smooth; capsule ovoid, 2 mm. long, ribbed; peristome double; calyptra naked. (Fig. 100, D–G.)

Turckheim 6918, 7495.

Distribution: Mexico, Costa Rica, South America.

I have seen no material of this species from Guatemala but Grout cites the two Turckheim collections by number. The above description was made from a Costa Rican collection.

10. MACROMITRIUM GUATEMALENSE C. M., Syn. **2**: 644. 1851.

Macromitrium rhystophyllum C. M., Bull. Herb. Boiss. **5**: 198. 1897.

Macromitrium subreflexum C. M., Bull. Herb. Boiss. **5**: 198. 1897.

Plants in dense greenish brown mats; branches erect, to 2 cm. high. Leaves crowded, crisped when dry, widely spreading when moist, 2.5–3 mm. long, narrowly lanceolate, sharply acute, minutely serrulate above and often toothed near apex; costa nearly percurrent; upper cells small, rounded, smooth, incrassate, basal cells linear, strongly tuberculose. Seta 4–6 mm. long, reddish; capsule oblong, strongly ribbed, urn brown, 2 mm. long; peristome double, teeth truncate, united in a cylinder about 275 μ high, endostome a pale, papillose cylinder about as high as teeth; calyptra naked; spores opaque, 25–28 μ. (Fig. 100, H–K.)

Dept. Huehuetenango: *Standley 81504, 82169, 82543, 82593a.* Dept. Quezaltenango: *Steyermark 33943.* Dept. Sacatepequez: *Standley 59368.* Dept. Chimaltenango: *Standley 57938a, 80952.* Dept. Baja Verapaz: *Standley 91187.* Dept. Zacapa: *Steyermark 29706.*

Distribution: Mexico, Costa Rica, Galapagos Islands.

On trees and rocks at medium altitudes. The shorter setae and spreading (not deflexed) leaves will help to separate this species from *M. punctatum.*

11. MACROMITRIUM PODOCARPI C. M., Bull. Herb. Boiss. **6**: 96. 1898.

Small plants in dense, trim mats, green above, brown below. Branches about 1 cm. high, densely reddish tomentose below. Leaves closely curled and twisted when dry, erect-flexuous when moist, narrowly lanceolate, carinate, entire, sharply acute, to 2 mm. long; costa ending in or near apex; upper cells small, diameter 5–6 μ, rounded, slightly incrassate, highly convex, basal cells narrowly oblong, tuberculate. Seta 3–5 mm. long; capsule ovoid, contracted below mouth when dry, urn 1.5 mm. long, bright brown; peristome double, teeth truncate, united in a cylinder about 225 μ high, endostome as long as teeth, pale, papillose, fragile. (Fig. 98, D–I.)

Dept. Quezaltenango: *Sharp 2049, 2090, 2199, 2200a.*

Distribution: Costa Rica, Honduras, South America.

On oaks at moderately high altitudes. A neat little moss with tightly curled, pointed leaves. The above collections mark the extreme northern limit of the range.

12. MACROMITRIUM PENTASTICHUM C. M., Linnaea **21**: 186. 1848.

Macromitrium hirtellum Bartr., Contr. U. S. Nat. Herb. **26**[3]: 86. 1928.

Plants in yellowish green tufts; branches slender, 2–4 cm. high. Leaves crowded, recurved and usually plainly 5 ranked when moist,

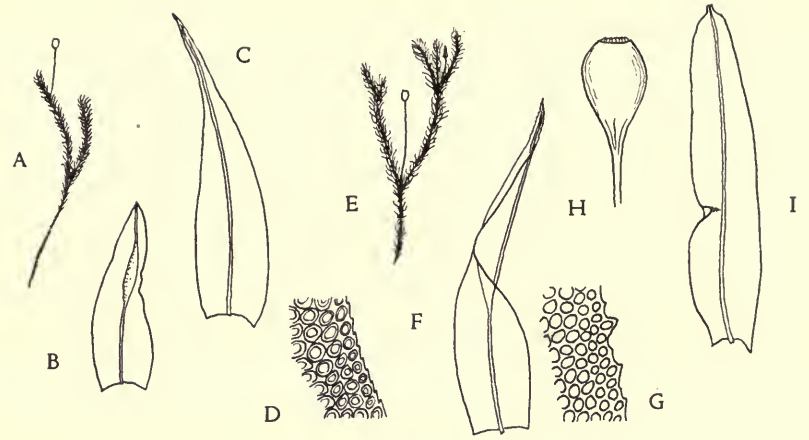

FIGURE 101

A–D, *Macromitrium pentastichum:* A, plant, ×1; B, leaf, ×14; C, perichaetial leaf, ×14; D, upper leaf cells and margin, ×270.

E–H, *Macromitrium cirrosum:* E, plant, ×1; F, leaf, ×14; G, upper leaf cells and margin, ×270; H, capsule, ×8.

I, *Macromitrium fragilicuspis:* I, leaf, ×14.

2–3 mm. long, oblong-lanceolate, acute to short acuminate, serrulate more than halfway down; costa short excurrent; upper cells rounded, obscure, mammillose, basal cells linear, smooth. Perichaetial leaves longer than the stem leaves, gradually acuminate; seta 6–8 mm. long, smooth; capsule short, ovoid, urn 1.5 mm. long, smooth; peristome double, teeth united in a cylinder, endostome equal to teeth in height; calyptra pilose, deeply laciniate at base. (Fig. 101, A–D.)

Dept. Peten: *Lundell 2679.*

Distribution: Mexico, British Honduras, Costa Rica, West Indies, South America.

On tree at low altitude. The slender habit, short pointed, spirally ranked leaves and pilose calyptra clearly distinguish this species.

13. MACROMITRIUM CIRROSUM (Hedw.) Brid., Bryol. Univ. **1**: 316. 1826.

Anictangium cirrosum Hedw., Sp. Musc. 42. 1801.

Slender, slightly glossy, yellowish plants tinged with brown; branches 2–4 cm. high, often dichotomously branched. Leaves crowded, flexuous and crispate when dry, 3–3.5 mm. long, gradually linear-lanceolate from an erect, oblong base, acuminate, serrulate

toward apex; costa percurrent; upper cells small, irregularly rounded, slightly incrassate, smooth or convex, narrower in acumen and linear, sinuose and tuberculose at base. Seta 8–15 mm. long or longer; capsule small, ovoid with a short neck, urn 1–1.5 mm. long, smooth or occasionally faintly ribbed; peristome double; calyptra naked. (Fig. 101, E–H.)

Dept. Izabal: *Steyermark 41746*. Dept. Alta Verapaz: *Standley 70344, 70350a, 70385, 91596a, 92073; Steyermark 44623, 45676a, 45680*. Dept. Chiquimula: *Steyermark 31488* (as *M. Steyermarkii*).

Distribution: Costa Rica, West Indies, South America.

On trees and rocks at medium to low altitudes. This is a variable species widely distributed through tropical America and has an extensive synonymy. In the above series Grout thinks that No. 41746 may represent the var. *stenophyllum* (Mitt.) Grout and No. 31488 the var. *jamaicense* (Mitt.) Grout.

14. MACROMITRIUM FRAGILICUSPIS Card., Rev. Bryol. **36**: 109. 1909.

Plants green, densely tufted, branches to 2 cm. high. Leaves crowded, erect and contorted when dry, 3–3.5 mm. long, narrowly lingulate, abruptly contracted to a very fragile, green, cuspidate point; costa percurrent; upper cells small, rounded-quadrate, smooth, basal cells linear, tuberculose. Seta 5–6 mm. long; capsule ovate-oblong, suberect, deeply furrowed when dry; peristome rudimentary, a short, papillose membrane; calyptra unknown. (Sporophyte not seen.) (Fig. 101, I.)

Dept. Guatemala: *Standley 80664*. Dept. Jalapa: *Steyermark 32532*.

Distribution: Mexico.

On trees and banks at medium altitudes. The leaf points of this curious species are so fragile that it is difficult to find a leaf intact. *Micromitrium fragile* Mitt. will be readily distinguished by the leaves, which are twisted spirally around the stem when dry, and the bordered leaf base.

5. MICROMITRIUM (Mitt.) Schimp. in Besch., Prodr. Bryol. Mex. 46. 1872.

Macromitrium subg. *Micromitrium* Mitt., Journ. Linn. Soc. **12**: 197. 1869.

Plants similar in appearance to *Macromitrium*. Stems densely foliate. Leaves contorted when dry, leaf cells nearly uniform,

distinctly bordered at base with several rows of linear cells extending well up the margins. Seta elongate, smooth; capsule subcylindric; peristome double; lid long beaked; calyptra naked, scarcely reaching the middle of the urn.

1. Leaf points fragile, elongate, mostly broken off.....1. *M. fragile*
   Leaves short pointed, not fragile.....2
2. Leaves obtuse, mucronate, spirally twisted around stem when dry.....3
   Leaves acute, apiculate, variously contorted, not spirally twisted.....4
3. Branches short, leaves obtuse or retuse, short mucronate..2. *M. mucronifolium*
   Branches longer, leaves strongly apiculate.....3. *M. apiculatum*
4. Leaves not or scarcely undulate.....4. *M. Wagnerianum*
   Leaves undulate.....5. *M. undosum*

1. MICROMITRIUM FRAGILE (Mitt.) Jaeg., Adumb. **1**: 435. 1872–73.

Macromitrium fragile Mitt., Journ. Linn. Soc. **12**: 218. 1869.

Micromitrium Schlumbergeri Schimp. in Besch., Prodr. Bryol. Mex. 47. 1871.

Slender yellowish green plants; stems branched, densely reddish tomentose below. Leaves crowded, spirally twisted around stem when dry with the points spreading, 2–3 mm. long, narrowly ovate-lanceolate, gradually narrowed to a long, slender, very brittle point which is broken off on all but the uppermost leaves; costa ending in acumen; upper cells small, rounded, incrassate, smooth, elongate only at extreme base near costa, border of linear, incrassate cells 12–14 rows wide at base quickly narrowing upward and extending to or beyond mid-leaf. Seta 6–8 mm. long; capsule oblong-cylindric, urn 3 mm. long; calyptra naked, covering only upper half of urn. (Fig. 102, A–D.)

Dept. Peten: *Lundell 2092, 2232, 2500a, 2528a, 3505.* Dept. Izabal: *Steyermark 39990.* Dept. Alta Verapaz: *Standley 70391, 90626, 90876, 92444.* Dept. Escuintla: *Standley 63499.*

Distribution: Mexico, West Indies, Central and South America.

On trees and rocks at low to medium altitudes. The species is sharply distinct in the fragile pointed leaves, closely spiraled when dry and distinctly bordered below the middle.

2. MICROMITRIUM MUCRONIFOLIUM (Hook. & Grev.) Grout, Bryol. **47**: 3. 1944.

Macromitrium mucronifolium Hook. & Grev., Edinb. Journ. Sci. **1**: 116. 1824.

Plants growing in extensive mats, green at tips, brown below; branches erect, to 5 mm. long. Leaves crowded, spirally twisted

around stem when dry, about 1.5 mm. long, carinate, lingulate, broadly obtuse to retuse, short mucronate, entire; costa strong, ending in mucro; cells rounded, nearly or quite smooth, slightly elongate only near insertion, 2–3 rows at basal margins linear, incrassate forming a narrow but distinct border extending only a short way up the leaf. Seta 3–6 mm. long, smooth; capsule oblong-ovoid, wide mouthed, urn 1.5 mm. long; peristome rudimentary; calyptra naked, covering the urn. (Fig. 102, E–G.)

Dept. Peten: *Bartlett 12315; Lundell 2319, 2851a, 2856.*

Distribution: Florida, Mexico, West Indies, Central and South America, Galapagos Islands.

On branches or trunks of trees at low altitudes. Dr. Grout has transferred this and the following species to Micromitrium and I think justly so. It is a frequent lowland plant in tropical America and will hardly be confused with anything but *M. apiculatum* from which it differs in the shorter branches and more broadly pointed leaves.

3. MICROMITRIUM APICULATUM (Hook.) Grout, Bryol. 47: 3. 1944.
Orthotrichum apiculatum Hook., Musc. Exot. tab. 45. 1818.

Plants in dense mats, yellowish green above, brown below; branches 1.5–3 or 4 cm. long. Leaves crowded, spirally twisted around

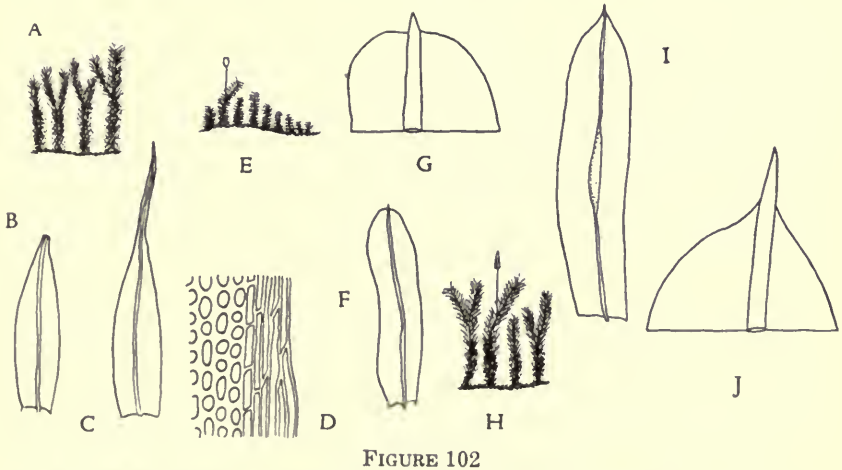

FIGURE 102

A–D, *Micromitrium fragile:* A, plant, ×1; B and C, leaves, ×14; D, basal cells and margin, ×270.

E–G, *Micromitrium mucronifolium:* E, plant, ×1; F, leaf, ×14; G, apex of leaf, ×54.

H–J, *Micromitrium apiculatum:* H, plant, ×1; I, leaf, ×14; J, apex of leaf, ×54.

stem when dry, 2.5–3 mm. long, lingulate, entire, narrowed at apex to a stout apiculus; costa excurrent; upper cells small, rounded, becoming more incrassate below, slightly elongate and sinuose near insertion, 6–10 rows at basal margins linear forming a distinct border, quickly narrowed upward and extending to about mid-leaf. Seta 6–8 mm. long; capsule ovoid with a wide mouth; calyptra naked. (Fig. 102, H–J.)

Dept. Alta Verapaz: *Standley 69464, 71583.*

Distribution: Mexico, West Indies, Central and South America.

On trees at medium altitudes. In addition to the distinctions made above *M. apiculatum* may be separated from *M. mucronifolium* by the larger leaves more strongly bordered below the middle.

4. MICROMITRIUM WAGNERIANUM (C. M.) Par., Ind. Bryol. Ed. 2, 3: 242. 1905.

Macromitrium chimborazense Spr., Journ. Linn. Soc. **12**: 218. 1869.

Macromitrium lamprocarpum C. M., Bull. Soc. Roy. Bot. Belg. **31**: 158. 1892.

?Macromitrium orthotrichaceum C. M., Bull. Herb. Boiss. **5**: 197. 1897.

Plants yellowish green above, brown below, growing in extensive mats; branches erect, to 2.5 cm. long. Leaves crowded, spreading on all sides, strongly crisped when dry, 2–2.5 mm. long, oblong-lanceolate, short acuminate, entire; costa ending just below apex; cells small, rounded, incrassate, smooth, elongate only at extreme base, 8–10 rows at basal margins linear forming a distinct yellowish border quickly narrowing upward and extending to about mid-leaf. Seta stout, 6–10 mm. long; capsule large, erect, oblong-cylindric, urn brown, often glossy, 3 mm. long, smooth or faintly ribbed; lid long beaked; calyptra naked, short, barely covering lid. (Fig. 103, A–D.)

Dept. Huehuetenango: *Standley 82368; Steyermark 49606.* Dept. Quezaltenango: *Steyermark 34232, 34387.* Dept. Solola: *Steyermark 47993.* Dept. Chimaltenango: *Standley 57929, 80953.* Dept. Guatemala: *Standley 58353, 80370.* Dept. Zacapa: *Steyermark 43182.*

Distribution: Mexico, West Indies, Central and South America.

On trees and rocks at medium altitudes. A frequent species in Central America and usually richly fruited. The relatively large, lustrous capsules and the strongly curled leaves spreading on all sides make recognition easy.

5. MICROMITRIUM UNDOSUM (Card.) Grout, Bryol. **47**: 4. 1944.

Macromitrium undosum Card., Rev. Bryol. **36**: 108. 1909.

Plants very similar to *M. Wagnerianum* and differing in no constant way that I can see except in the more strongly undulate leaves. (Fig. 103, E.)

Dept. Chimaltenango: *Standley 80953* (as *M. lamprocarpum*). Dept. Guatemala: *Standley 80370* (as *M. lamprocarpum*).

Distribution: Mexico, Costa Rica.

On trees at moderate altitudes. This appears to me to be a very weak species and I have little doubt but that eventually it will have to be combined with *M. Wagnerianum.*

EXCLUDED SPECIES

MACROMITRIUM SEMIMARGINATUM C. M., Bull. Herb. Boiss. **5**: 197. 1897.

MACROMITRIUM CARIONIS C. M., Bull. Herb. Boiss. **5**: 199. 1897.

These species evidently belong in *Micromitrium* but no authentic material is available for comparison.

6. SCHLOTHEIMIA Brid., Musc. Rec. Suppl. **4**: 114. 1819.

Medium sized plants growing in extensive mats, usually lustrous and reddish brown or green at tips; branches numerous, suberect, densely foliate, tomentose. Leaves erect and usually spirally twisted around stem when dry, lanceolate or lingulate, entire; costa strong; cells small, incrassate. Seta erect; capsules erect, subcylindric, smooth; peristome double; lid long beaked; calyptra large, cylindric-campanulate, not plicate, lobed at base, covering the capsule.

1. Leaf acumen linear, very fragile, mostly broken off.....3. *S. angustata*
   Leaves not fragile, acuminate or mucronate.....2
2. Leaves rugose, lingulate, mucronate.....1. *S. rugifolia*
   Leaves not rugose, lanceolate, acuminate.....2. *S. sublaevifolia*

1. SCHLOTHEIMIA RUGIFOLIA (Hook.) Schwaegr., Suppl. **2**^{2}: pl. 139. 1826.

Orthotrichum rugifolium Hook., Musc. Exot. tab. 128. 1820.

Schlotheimia Sullivantii C. M., Syn. **1**: 756. 1849.

Autoicous; branches crowded, to 2 cm. high. Leaves appressed and slightly spiraled when dry, to 2 mm. long, lingulate, abruptly

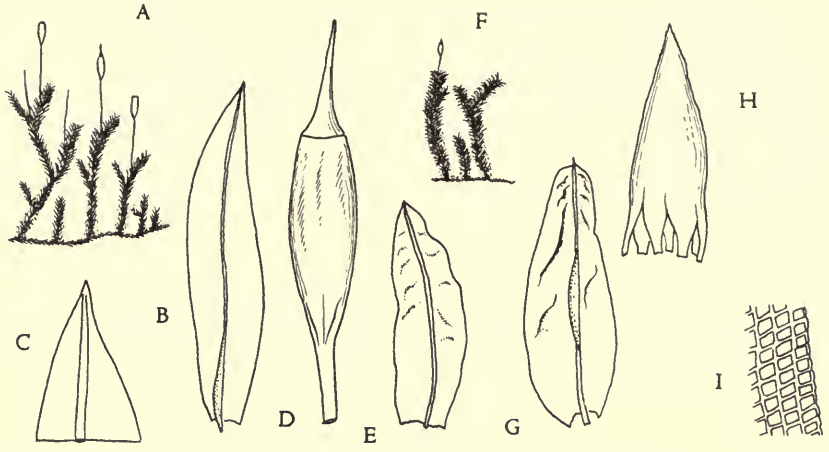

FIGURE 103

A–D, *Micromitrium Wagnerianum:* A, plant, ×1; B, leaf, ×18; C, apex of leaf, ×54; D, capsule, ×8.

E, *Micromitrium undosum:* E, leaf, ×14.

F–I, *Schlotheimia rugifolia:* F, plant, ×1; G, leaf, ×16; H, calyptra, ×8; I, upper leaf cells and margin, ×270.

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short mucronate, rugose above; costa strong, short excurrent; cells smooth, the upper small, rounded, basal cells linear, very incrassate, sinuose. Perichaetial leaves little differentiated; seta 2–4 mm. long; capsule oblong-cylindric, urn 2 mm. long; calyptra 3–4 mm. long, pale, scabrous near apex, deeply lobed at base, covering the whole capsule. (Fig. 103, F–I.)

Dept. Alta Verapaz: *Standley 70391a, 91651a; Steyermark 45667.* Dept. Jalapa: *Steyermark 32432, 32532a; Standley 76566, 77401.*

Distribution: Southern United States, Mexico, West Indies, Central and South America.

On trees and shaded rocks at low altitudes. This is by far the commonest species in tropical America and has an extensive synonymy.

2. SCHLOTHEIMIA SUBLAEVIFOLIA C. M., Nuov. Giorn. Bot. Ital. N. S. 4: 126. 1897.

Glossy reddish brown plants, yellowish toward tips, growing in dense tufts or mats; branches to 3 cm. long, densely foliate, felted with reddish tomentum below. Leaves spirally twisted around stem when dry, erect-spreading when moist, to 3 mm. long, 0.9 mm. wide,

oblong-lanceolate, rather abruptly narrowed to a slender apiculus, strongly carinate; margins plane except for a slight curvature on one side near base; costa brownish, 50 μ wide below, ending in apiculus; upper leaf cells obliquely oval toward costa, longer diameter about 18 μ, incrassate, smaller and rounded toward margins, basal cells narrowly rectangular. (Fig. 104, A–C.)

Dept. Alta Verapaz: *Standley 92360, 92361a.* Dept. Zacapa: *Steyermark 29947* (as *S. sarcotricha*).

Distribution: Bolivia.

On trees at moderate altitudes. Apparently near *S. lancifolia* Bartr. of North Carolina but more robust, with longer, broader leaves, more elongated, obliquely oval juxta costal upper leaf cells and abruptly narrowed at apex to a more pronounced slender apiculus.

3. SCHLOTHEIMIA ANGUSTATA Mitt., Journ. Linn. Soc. **12**: 223. 1869.

Schlotheimia sarcotricha C. M., Bull. Herb. Boiss. **5**: 196. 1897.

Plants slender, brownish green, darker below, densely tufted; stems to 1.5 cm. high, densely felted with reddish tomentum below. Leaves crowded, spirally appressed with spreading points, 2–2.5 mm.

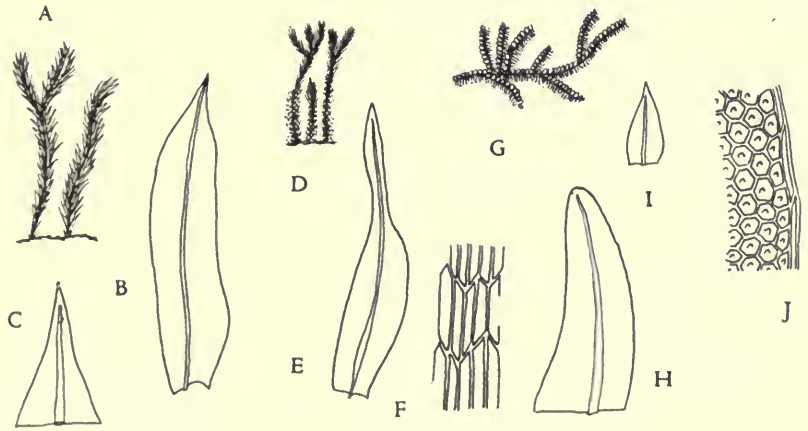

FIGURE 104

A–C, *Schlotheimia sublaevifolia:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×54.
D–F, *Schlotheimia angustata:* D, plant, ×1; E, leaf, ×14; F, basal leaf cells, ×270.
G–J, *Helicophyllum torquatum:* G, part of plant, ×1; H, lateral leaf, ×16; I, dorsal leaf, ×16; J, upper leaf cells and margin, ×270.

long, oblong-ovate, rather quickly contracted to a long, linear-subulate, acute, fragile point, entire, slightly rugulose; costa ending near point of acumen; upper cells small, smooth, rounded-quadrate, often wider than long, basal cells linear, smooth, incrassate with very narrow sinuose lumens. Seta short; capsule narrowly cylindrical, small mouthed, slightly sulcate; lid beaked; calyptra lobed at base; peristome double. Sporophyte not seen. (Fig. 104, D–F.)

Dept. Alta Verapaz: *Standley 92160.*

Distribution: Peru, Bolivia.

On tree at moderate altitude. This highly individual species looks much like *Micromitrium fragile* to the naked eye but the leaf base is unbordered and the areolation quite different. *Macromitrium fragilicuspis* may be separated by the tuberculose basal cells and the different cell structure.

23. HELICOPHYLLACEAE

Plants growing in extensive, dense mats. Stems elongate, creeping, irregularly branched, densely tomentose on the under side. Lateral leaves in 2 opposite rows, strongly incurled when dry, lingulate, rounded at apex, bordered; costa strong; cells hexagonal, papillose. Dorsal leaves in 2 rows, much smaller. Sporophyte terminal on lateral branches; capsules immersed; peristome lacking.

1. HELICOPHYLLUM Brid., Bryol. Univ. **2**: 771. 1827.

Plants with the characters of the family.

1. HELICOPHYLLUM TORQUATUM (Hook.) Brid., Bryol. Univ. **2**: 771. 1827.

Anictangium torquatum Hook., Musc. Exot. tab. 41. 1818.
Helicophyllum guatemalense C. M., Bull. Herb. Boiss. **5**: 201. 1897.

Dioicous; plants rigid, yellowish green; stems to 4 or 5 cm. long, much branched. Leaves dimorphous, lateral rows closely incurled when dry, 1.5–2 mm. long, lingulate, rounded at apex, narrowly bordered; costa ending below apex; cells rounded-hexagonal, unipapillate, bordered all around with a single row of narrowly linear, smooth cells. Dorsal leaves smaller, slenderly acuminate from an ovate base, areolation more pellucid, faintly papillose. Seta very short; capsule immersed, oblong-cylindric, smooth. (Fig. 104, G–J.)

Dept. Peten: *Lundell 3523*. Dept. Suchitepequez: *Steyermark 47733*. Dept. Escuintla: *Standley 89061*. Dept. Zacapa: *Steyermark 29397*. Dept. Santa Rosa: *Standley 77869, 78099, 78216*.

Distribution: Mexico, West Indies, Central and South America.

On trees and rocks at low altitudes. Although rarely fruiting this monotypic species is so sharply distinct that it could hardly be confused with anything else.

24. RHACOPILACEAE

Medium sized creeping plants with radiculose stems and dimorphous leaves. Lateral leaves in 2 rows, contorted when dry. Dorsal leaves much smaller, in 2 rows; costa strong; cells rounded. Seta elongate; capsules nodding, ribbed when dry; peristome double, complete; calyptra cucullate, pilose.

1. RHACOPILUM P. Beauv., Prodr. 36. 1805.

Plants with the characters of the family.

1. RHACOPILUM TOMENTOSUM (Hedw.) Brid., Bryol. Univ. **2**: 719. 1827.

Hypnum tomentosum Hedw., Sp. Musc. 240. 1801.

Autoicous; plants yellowish green, growing in mats. Stems elongate, radiculose, freely branched. Lateral leaves to 2 mm. long, contorted when dry, ovate, subulate by the long, excurrent costa, coarsely and sharply serrate above middle, not bordered; cells small, hexagonal, smooth or nearly so. Dorsal leaves smaller, more gradually pointed, subentire. Seta 1.5–3 cm. long, smooth; capsule curved, oblong-cylindric, urn 3–5 mm. long, ribbed when dry; lid beaked. (Fig. 105, A–D.)

Dept. Peten: *Bartlett 12251, 12516, 12646, 12714, 12749*. Dept. Alta Verapaz: *Standley 71734, 71756*. Dept. Huehuetenango: *Steyermark 49108*. Dept. San Marcos: *Standley 66180*. Dept. Totonicapan: *Standley 65930*. Dept. Quezaltenango: *Standley 65450, 67271, 86154, 86156a, 86863, 87922; Steyermark 34343*. Dept. Sacatepequez: *Standley 81021, 81024*. Dept. Escuintla: *Standley 61314*. Dept. Chimaltenango: *Standley 79783*. Dept. Baja Verapaz: *Standley 69785, 69786b, 69791*.

Distribution: Florida, Mexico, West Indies, Central and South America.

On trees, rocks, logs and humus at various altitudes. Widely distributed through the American tropics and quite variable.

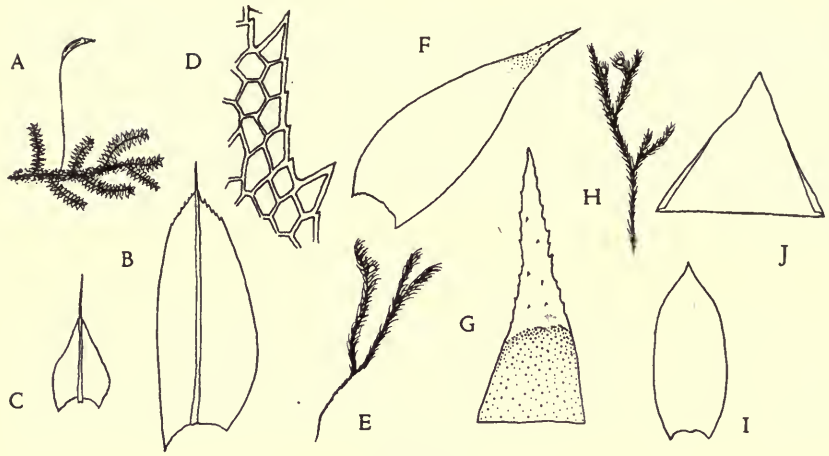

FIGURE 105

A–D, *Rhacopilum tomentosum:* A, plant, ×1; B, lateral leaf, ×16; C, dorsal leaf, ×16; D, upper leaf cells and margin, ×270.

E–G, *Hedwigia ciliata:* E, plant, ×1; F, leaf, ×16; G, apex of leaf, ×54.

H–J, *Hedwigidium imberbe:* H, plant, ×1; I, leaf, ×16; J, apex of leaf, ×54.

25. HEDWIGIACEAE

Plants usually in dense tufts or mats; stems stiff, elongated, irregularly branched, often stoloniferous; cells papillose. Seta short to elongate; capsules erect; peristome lacking; calyptra small.

1. Leaves bordered ..... 4. *Rhacocarpus*
   Leaves not bordered 2
2. Capsules exserted, setae elongate ..... 3. *Braunia*
   Capsules immersed 3
3. Leaves with hyaline hair points ..... 1. *Hedwigia*
   Leaves not hyaline tipped ..... 2. *Hedwigidium*

1. HEDWIGIA Hedw., Sp. Musc. 40. 1801 in part.

Plants green, hoary, rupestrine, tufted; stems branched. Leaves closely imbricated, hyaline tipped. Perichaetial leaves ciliate; capsule immersed, subglobose.

1. HEDWIGIA CILIATA Hedw., Sp. Musc. 40. 1801 (synonym).

Anictangium ciliatum Hedw., Sp. Musc. 40. 1801.

Autoicous; plants growing in hoary tufts; stems stiff, to 4 cm. long or longer, irregularly branched. Leaves imbricated with

spreading points when dry, spreading when moist, to 3 mm. long, ovate, the hyaline tips conspicuous and serrulate; upper cells oblong, incrassate, papillose, inner basal cells elongate, sinuose, quadrate toward margins. Seta terminal, very short; capsule subglobose, wide mouthed. (Fig. 105, E–G.)

Dept. Quezaltenango: *Standley 66412, 83261, 85256.*

Distribution: Cosmopolitan.

On rocks and banks at high altitudes. These three collections are clearly referable to the var. *leucophaea* Bry. Eur. having broad, long, hyaline leaf points and nearly plane margins.

2. HEDWIGIDIUM Bry. Eur. fasc. **29–30.** 1846.

Plants with the habit of *Hedwigia* but yellowish at tips and brown below. Leaves closely imbricated when dry, not hyaline tipped. Perichaetial leaves not ciliate; capsules immersed, gymnostomous.

1. HEDWIGIDIUM IMBERBE (Smith) Bry. Eur. fasc. **29–30,** Mon. p. 3, t. 1. 1846.

Gymnostomum imberbe Smith, Engl. Bot. 2237. 1790–1814.

Autoicous; stems sparingly branched, to 4 or 5 cm. long. Leaves crowded, imbricated, ovate, concave, short acuminate, to 1.7 mm. long; margins revolute, irregularly crenulate near apex; upper cells narrowly oblong, incrassate, sinuose, inner basal cells linear, incrassate, sinuose, quadrate toward margins. Perichaetial leaves larger, not ciliate; capsule immersed. (Fig. 105, H–J.)

Dept. Quezaltenango: *Standley 67706, 67715, 67757, 83792, 85751; Steyermark 34211a.* Dept. Solola: *Steyermark 46962, 47467.*

Distribution: Mexico, South America, Europe, Africa, Australia, New Zealand.

On rocks at high to very high altitudes. This species is readily separated from *Hedwigia* by the brownish color and concolorous leaf points but as Thériot has remarked (Thériot 27, Pt. 3, p. 31) the leaves are so close in structural details to those of *Braunia secunda* that it is difficult to distinguish them in the absence of fruit.

3. BRAUNIA Bry. Eur. fasc. **29–30.** 1846.

Plants tufted, yellowish at tips, brown below; stems rigid, stoloniferous, irregularly branched. Leaves crowded, imbricated

when dry, ovate, plicate, entire; cells small, papillose, sinuose. Seta slender, elongate; capsules erect, gymnostomous; lid short, apiculate; calyptra cucullate.

Capsules globose.....1. *B. squarrulosa*
Capsules cylindrical.....2. *B. secunda*

1. BRAUNIA SQUARRULOSA (Hampe) Broth., E. & P. Pflanzenf. 1^3: 718. 1905.

Harrisonia squarrulosa Hampe, Icon. Musc. 19. 1844.
Neckera sphaerocarpa C. M., Syn. 2: 105. 1851.

Plants in intricate mats; stems freely branched, to 7 or 8 cm. long, branches curved, often flagelliform. Leaves closely imbricated with squarrose-spreading points when dry, 2–2.5 mm. long, about 1 mm. wide, ovate, narrowed to a slender acumen which is often hyaline at the capillary tip, concave, plicate; margins recurved about ⅔ up, erose-denticulate near apex; upper cells oblong, incrassate, very sinuose, papillose, inner basal cells linear, quadrate or wider than long toward margins. Seta 3–4 mm. long; capsule subglobose, often slightly rugulose and constricted under mouth when dry and empty, urn 1–1.5 mm. long. (Fig. 106, A–C.)

Dept. Huehuetenango: *Standley 62629, 65606, 81153, 81817, 82081, 82548, 82593, 82682a; Steyermark 50604.* Dept. San Marcos: *Steyermark 35481, 35482b; Standley 66126, 68620.* Dept. Totonicapan: *Standley 62674, 84435.* Dept. Quezaltenango: *Standley 85220, 86156.*

Distribution: Mexico.

On trees and rocks at medium to high altitudes. Readily distinguished from *B. secunda* by the shorter setae, globose capsules and the capillary leaf tips spreading or recurved when dry.

2. BRAUNIA SECUNDA (Hook.) Bry. Eur. fasc. **29–30.** 1846.

Hedwigia secunda Hook., Musc. Exot. tab. 46. 1818.

Plants dull yellowish green, laxly tufted; stems rigid, branched, to 4 or 6 cm. long. Leaves crowded, closely imbricated, slightly secund near tips, to 2 mm. long, 1 mm. wide, ovate, acuminate, faintly plicate; margins narrowly recurved below, erose-denticulate near apex; upper cells oblong, sinuose, incrassate, papillose, inner basal cells linear, quadrate toward margins. Seta 8–10 mm. long; capsule ovoid-cylindrical, narrowed above, urn 1.5–2 mm. long. (Fig. 106, D–F.)

Dept. Quezaltenango: *Standley 65526, 83237, 85807, 85253.*

Distribution: Arizona, Mexico, Bolivia, Africa, India.

On shaded rocks at moderately high altitudes. These plants approach the var. *Andrieuxii* (Lor.) Thér. in the leaf margins narrowly recurved only near the base but I doubt if this form can be practically segregated.

4. RHACOCARPUS Lindb., Oefv. K. Vet.-Akad. Forh. **1863**: 603. 1863.

Dioicous; plants brownish, yellow at tips; stems elongate, freely branched. Leaves imbricated when dry, concave, ecostate, usually hair tipped, distinctly bordered; cells elongate, minutely but densely papillose, smooth and highly colored at extreme base. Seta elongate; capsule ovoid, ribbed when dry, gymnostomous.

1. RHACOCARPUS HUMBOLDTII (Hook.) Lindb., Oefv. K. Vet.-Akad. Forh. **1863**: 603. 1863.

Hedwigia Humboldtii Hook., Musc. Exot. tab. 137. 1818.

Stems pinnately branched, 6–8 cm. long or longer, branches short, curved, cuspidate at tips. Stem leaves 2–2.5 mm. long, broadly obovate, contracted above base, rounded above and abruptly pili-

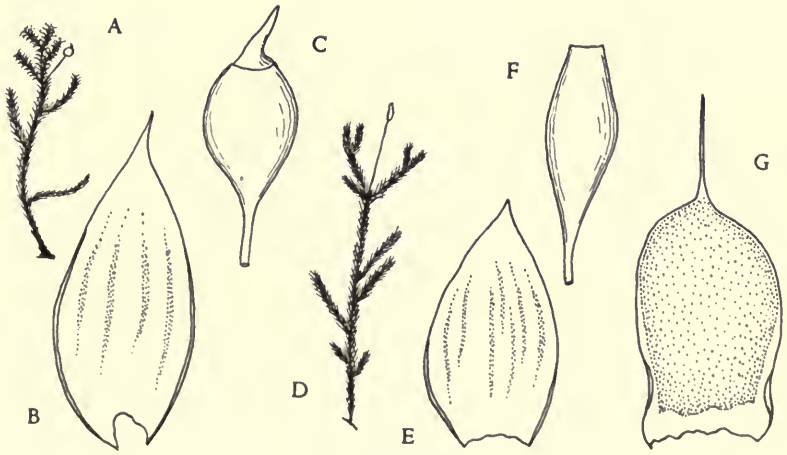

FIGURE 106

A–C, *Braunia squarrulosa:* A, part of plant, ×1; B, leaf, ×16; C, capsule, ×12.
D–F, *Braunia secunda:* D, plant, ×1; E, leaf, ×16; F, capsule, ×12.
G, *Rhacocarpus Humboldtii:* G, leaf, ×16.

ferous in a long, glossy, brownish hair point, bordered all around; margins recurved below, serrulate toward apex; cells linear, obscure, densely papillose, reddish brown and smooth at extreme base, 4–6 rows at margins smooth and pellucid forming a yellowish border merging with the colored cells at base, alar cells oblong, deeply colored, incrassate. Branch leaves similar but smaller. Seta about 1 cm. long; calyptra cucullate, naked. (Fig. 106, G.)

Dept. San Marcos: *Steyermark 36499.*

Distribution: Mexico, West Indies, Central and South America, Africa.

On moist, shaded bank at high altitude. The leaves of this moss are striking and beautiful objects under a microscope.

26. CRYPHAEACEAE

Autoicous; plants slender, rigid; primary stems creeping, secondary stems elongate, suberect, branched. Leaves imbricated when dry, concave, ovate or lanceolate; costa single; cells smooth or faintly papillose, oval or slightly elongate, subquadrate at basal margins. Seta short; capsules usually immersed; peristome double, rarely single; lid conical; calyptra small, conical.

1. Sporophyte lateral on stems and branches, nearly sessile.....2. *Cryphaea*
   Sporophyte terminal on longer branches.....2
2. Short, rigid plants, peristome single.....1. *Acrocryphaea*
   Long, slender, pendulous plants, peristome double.....3. *Dendropogonella*

1. ACROCRYPHAEA Bry. Eur. **5** Monog. Cryph. 2. 1851–55.

Secondary stems rigid, julaceous, branched above. Leaves appressed, ovate; cells oval, incrassate. Sporophyte terminal on leafy branches of varying length. Seta short; capsules immersed; peristome single, of 16 papillose teeth.

1. ACROCRYPHAEA GARDNERI (Mitt.) Jaeg., Adumb. **2**: 94. 1874–75.

Cryphaea Gardneri Mitt., Journ. Linn. Soc. **12**: 415. 1869.

Plants rigid, yellowish green, in lax tufts; secondary stems 2–3 cm. long, subpinnately branched. Leaves closely imbricated, 1–1.5 mm. long, ovate, short acuminate; margins recurved nearly to base of acumen, minutely serrulate near apex; costa strong, ending about ⅔ up leaf; upper cells oval, incrassate, minutely papillose, basal

cells linear near costa, obliquely oval in many rows toward margins. Inner perichaetial leaves cuspidate by the long excurrent costa; capsule ovoid, immersed, peristome teeth brown, papillose. (Fig. 107, A–C.)

Dept. Alta Verapaz: *H. Johnson 243.*

Distribution: Costa Rica, Panama, Cuba, South America.

On trees. The terminal capsules on short, leafy branches will distinguish this species from *Cryphaea.* It is apparently widely distributed but local.

2. CRYPHAEA Mohr, in Web., Tab. Synop. Musc. 1813.

Secondary stems slender, ascending, subpinnately branched. Leaves ovate, short pointed, entire or serrulate above; costa extending to or above mid-leaf; cells oval, smooth or faintly papillose, incrassate. Perichaetial leaves scarious, mostly blunt, aristate by the long excurrent costa; capsules ovoid, immersed; peristome double.

1. Leaves entire or minutely denticulate....2
   Leaves irregularly serrate with coarse teeth....4
2. Leaf margins revolute....3. *C. intermedia*
   Leaf margins plane....3
3. Leaves ovate, upper cells elongate, costa weak....1. *C. filiformis*
   Leaves broadly ovate, upper cells short, costa strong....2. *C. pinnata*
4. Leaves broadly ovate, short acuminate, cells rounded....4. *C. patens*
   Leaves ovate-lanceolate, long acuminate, cells oval....5. *C. reticulata*

1. CRYPHAEA FILIFORMIS (Hedw.) Brid., Bryol. Univ. **2**: 252. 1827.

Neckera filiformis Hedw., Sp. Musc. 202. 1801.

Secondary stems very slender, 5–6 cm. long, laxly pinnate, branches filiform, divergent, about 1 cm. long, terete. Leaves ovate, acuminate, 1–1.5 mm. long; margins erect, minutely serrulate near apex; costa faint, ending near mid-leaf; cells linear, incrassate, 6–8 rows at basal margins short, mostly wider than long. Perichaetial leaves oblong, abruptly contracted to a long, denticulate arista formed by the excurrent costa; capsule ovoid-cylindric, urn 1.5 mm. long; peristome double, segments as long as teeth. (Fig. 107, D–F.)

Dept. Peten: *Lundell 2123c.* Dept. Chimaltenango: *Standley 58741a, 61936a.*

Distribution: Mexico, West Indies, South America.

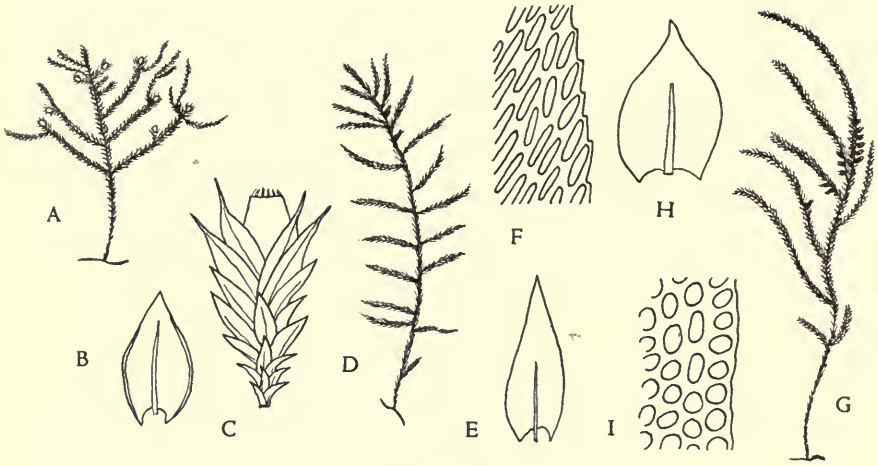

FIGURE 107

A–C, *Acrocryphaea Gardneri:* A, plant, ×1; B, leaf, ×14; C, sporophyte bearing branch, ×8.

D–F, *Cryphaea filiformis:* D, plant, ×1; E, leaf, ×14; F, upper leaf cells and margin, ×270.

G–I, *Cryphaea pinnata:* G, plant, ×1; H, leaf, ×16; I, upper leaf cells and margin, ×270.

On logs mostly at high altitudes. The above numbers represent a few plants segregated from other mosses but seem to agree closely with the description. The long, narrow leaf cells are distinctive.

2. CRYPHAEA PINNATA Schimp. in C. M., Syn. **2**: 675. 1851.

Plants slender, reddish brown; secondary stems to 10 cm. long, laxly pinnate, branches to 3 cm. long, scarcely attenuate. Leaves 1.8 mm. long, 1 mm. wide, broadly ovate from a cordate base, abruptly short acuminate; margins plane, entire or minutely crenulate near apex; costa stout, ending above mid-leaf; cells short, oval, incrassate, elongate only near costa at extreme base. Perichaetial leaves oblong-obovate, broader above, abruptly aristate by the excurrent costa, arista minutely denticulate. Capsule ovoid, 1.25 mm. long; segments of endostome fragile, as long as teeth; annulus broad, compound; lid conical; calyptra 0.5 mm. long, scabrous; spores 35–40 μ. (Fig. 107, G–I.)

Dept. Alta Verapaz: *Standley 69253, 69556a, 71021a, 71798.*

Distribution: Mexico.

On trees at medium altitudes. There will be no difficulty in separating this species from *C. filiformis* but until a critical study of the numerous Mexican species is made the group cannot be resolved satisfactorily.

3. CRYPHAEA INTERMEDIA C. M., Linnaea **19**: 212. 1847.

Secondary stems to 7 or 8 cm. long, rigid, densely tufted, yellowish green above, dark brown below, irregularly pinnate, branches widely spreading, to 1.5 cm. long, obtuse or slightly attenuate. Stem leaves 2 mm. long, 1.2 mm. wide, broadly ovate from a cordate base, abruptly acuminate; margins entire, strongly revolute to base of acumen; costa slender, ending slightly above mid-leaf; upper cells small, oval, incrassate, about 10 μ long, 5 μ wide, basal cells linear and pellucid near costa, shorter and rounded toward margins. Branch leaves similar but smaller. (Fig. 109, A–C.)

Dept. El Quiche: *Sharp 2374*.

Distribution: Mexico, Ecuador?

On bark of *Carpinus* at moderate altitude. Distinguished from all its local associates by the broadly ovate, entire leaves with the margins revolute nearly to base of acumen. The Guatemalan plants match perfectly a herbarium specimen from Ecuador named *C. latifolia* Mitt. Either *C. intermedia* ranges to Ecuador or *C. latifolia*, as I suspect, is a synonym of Muller's species.

4. CRYPHAEA PATENS Hornsch. in C. M., Syn. **2**: 171. 1851.

Plants rigid, growing in dense tufts; secondary stems to 4 cm. long, often longer, rather coarse, laxly pinnate, branches short, spreading. Leaves erect-spreading and laxly imbricated when dry, about 2 mm. long, broadly ovate from a cordate base, short acuminate; margins strongly revolute, distinctly toothed near apex; costa strong, ending near apex; cells small, rounded, 8–10 μ, moderately incrassate. Perichaetial leaves abruptly contracted to a long, minutely denticulate arista; costa faint; capsule narrowly ovoid. (Fig. 108, A–C.)

Dept. Quezaltenango: *Standley 66389b*. Dept. Sacatepequez: *Standley 58873, 63711a*. Dept. Chimaltenango: *Standley 62030b* (as *C. reticulata*), *81074*.

Distribution: Mexico, Costa Rica, Ecuador, Bolivia.

On trees at moderate altitudes. The broad, short pointed leaves, toothed above and the short, rounded cells scarcely longer than broad are significant characters in the local group of species.

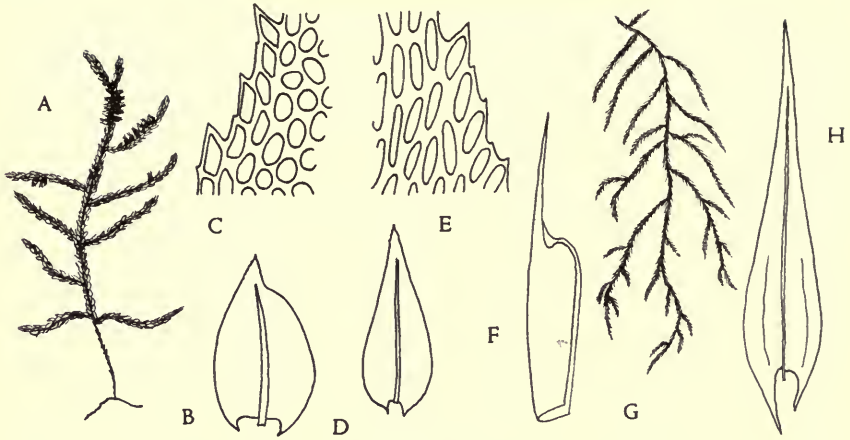

FIGURE 108

A–C, *Cryphaea patens:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270.

D–F, *Cryphaea reticulata:* D, leaf, ×14; E, upper leaf cells and margin, ×270; F, perichaetial leaf, ×14.

G–H, *Dendropogonella rufescens:* G, part of plant, ×1; H, leaf, ×16.

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5. CRYPHAEA RETICULATA Besch., Prodr. Bryol. Mex. 69. 1871.

Plants slender, yellowish green; stems to 7 cm. long, branches elongate, often attenuate. Stem leaves 2 mm. long, ovate-lanceolate, gradually acuminate, decurrent; margins recurved below, serrate for some distance below apex; costa ending near apex; cells oval, incrassate, the upper 2–3 times longer than wide, more elongate at extreme base. Perichaetial leaves membranous, more or less emarginate, long aristate pointed, ecostate; capsule cylindrical, urn 1.5 mm. long; calyptra scabrous; spores 18–24 μ. (Fig. 108, D–F.)

Dept. Alta Verapaz: *Standley 69976a, 69981, 90368a* (as *C. pinnata*). Dept. Quezaltenango: *Standley 66350.* Dept. Solola: *Steyermark 47580* (as *C. attenuata*). Dept. Guatemala: *Standley 80654* (as *C. patens*).

Distribution: Mexico.

On trees at medium to high altitudes. More slender than *C. patens* and distinct in the narrower, longer acuminate leaves, the more elongated leaf cells and the broadly rounded or emarginate perichaetial leaves.

3. DENDROPOGONELLA E. G. Britt., Bryol. **9**: 39. 1906.

Very slender, bright reddish brown plants, golden yellow at tips, growing in pendulous masses; secondary stems very long, copiously

branched. Leaves lanceolate, decurrent, acuminate; costa strong, percurrent; cells smooth, oval-hexagonal. Capsules immersed; peristome double; lid conical; calyptra small.

1. DENDROPOGONELLA RUFESCENS (C. M.) E. G. Britt., Bryol. 9: 39. 1906.

Cryphaea rufescens C. M., Linnaea 18: 682. 1844.

Secondary stems to 20 cm. or more long, pinnately branched, branches divergent, to 1.5 cm. long. Leaves laxly imbricated with spreading points when dry, 3–4 mm. long, gradually long and finely acuminate from a lanceolate, biplicate, decurrent base; margins narrowly recurved near base, minutely serrulate toward apex; costa slender, ending in acumen; upper cells linear-rhomboidal, smooth, incrassate, shorter and oblong at extreme base and toward basal margins. Capsule ovoid, immersed; peristome segments from a low basal membrane, shorter than teeth; calyptra smooth. (Fig. 108, G–H.)

Dept. Huehuetenango: *Steyermark 48485, 49902, 50553.* Dept. San Marcos: *Steyermark 35882a, 35883.* Dept. Totonicapan: *Standley 62722.* Dept. El Progresso: *Steyermark 43673.*

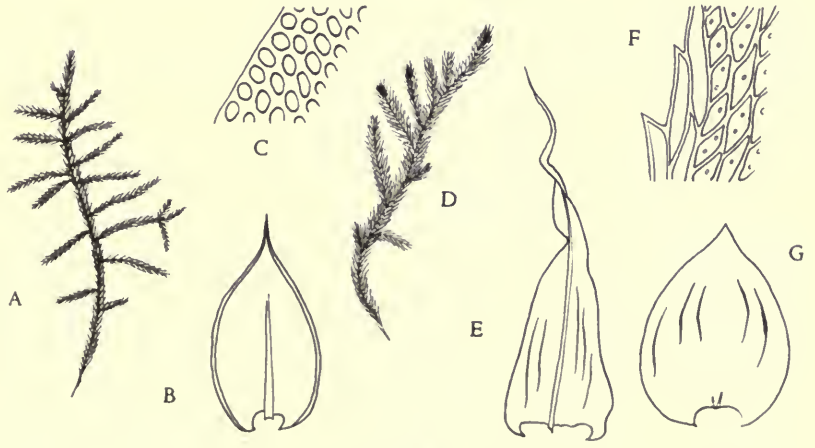

FIGURE 109

A–C, *Cryphaea intermedia:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270.

D–F, *Trachypodopsis otiophylla:* D, plant, ×1; E, leaf, ×14; F, upper leaf cells and margin, ×270.

G, *Jaegerinopsis scariosa:* G, leaf, ×12.

Distribution: Mexico, Island of St. Thomas.

Epiphyte on trees, mostly at high altitudes. The ruddy color and the slender, branched stems in pendulous masses identify this species at a glance.

27. LEUCODONTACEAE

Fairly robust plants; secondary stems mostly laxly ascending or pendulous, simple or branched, julaceous. Leaves crowded, appressed, ovate, short pointed, subentire; costa single, double or lacking; cells mostly smooth, short, incrassate, quadrate or wider than long in numerous rows toward basal angles. Seta short; capsules ovoid, erect, usually exserted; peristome double, endostome rudimentary; lid conic-rostrate; calyptra cucullate, usually naked.

1. Leaf cells papillose ..... 3. *Leucodontopsis*
   Leaf cells smooth 2
2. Costa lacking ..... 1. *Leucodon*
   Costa single, nearly percurrent ..... 2. *Pseudocryphaea*

1. LEUCODON Schwaegr., Suppl. 1[2]: 1. 1816.

Dioicous; secondary stems loosely tufted, sparingly branched, curved or subpendulous, brown below, green at tips. Leaves erect, concave, spreading when moist, ovate, acuminate, ecostate, plicate; cells smooth, elongate, small and rounded in many rows toward basal margins. Capsules usually exserted on a short seta.

1. LEUCODON CURVIROSTRIS Hampe, Ic. Musc. 16. 1844.

Robust plants growing in tufts, yellowish green at tips, brown below; secondary stems 2–10 cm. long, sparingly branched, curved. Leaves often secund, ovate-lanceolate, acuminate, 3–3.5 mm. long, faintly plicate; margins plane, minutely serrulate above; cells linear, 6–8 times as long as wide, incrassate, smooth, small and rounded in many rows at basal angles. Perichaetial leaves convolute, elongate, often extending to base of capsule; seta 3–5 mm. long, straight or slightly curved; capsule large, ovoid, small mouthed, exserted, urn 3 mm. long; lid obliquely beaked, 1 mm. long; peristome teeth 0.37 mm. long, pale, faintly papillose, endostome rudimentary; spores irregular, round or reniform, to 75 μ. (Fig. 110, A–B.)

Dept. Huehuetenango: *Steyermark 50146; Standley 65606a, 81159, 81820.* Dept. Totonicapan: *Standley 84521.* Dept. Quezaltenango: *Standley 66389a.*

Distribution: Mexico.

On trees, rocks and logs at high altitudes. The setae vary considerably in length but the capsules are never immersed as in *L. cryptotheca* Hampe.

2. PSEUDOCRYPHAEA E. G. Britt., Bull. Torr. Bot. Club **32**: 261. 1905.

Loosely tufted, rigid plants; secondary stems freely branched, julaceous, usually with numerous slender, short, microphyllous branchlets. Leaves ovate; costa single; cells narrow. Capsules ovoid, long exserted.

1. PSEUDOCRYPHAEA FLAGELLIFERA (Brid.) E. G. Britt., Bull. Torr. Bot. Club **32**: 261. 1905.

Pilotrichum flagelliferum Brid., Bryol. Univ. **2**: 259. 1827.

Secondary stems to 5 or 6 cm. long; branches elongate, microphyllous branchlets usually present. Leaves imbricated when dry, ovate, short acuminate; margins plane, serrulate above; costa slender, ending near apex; cells linear-rhomboidal, often faintly papillose on

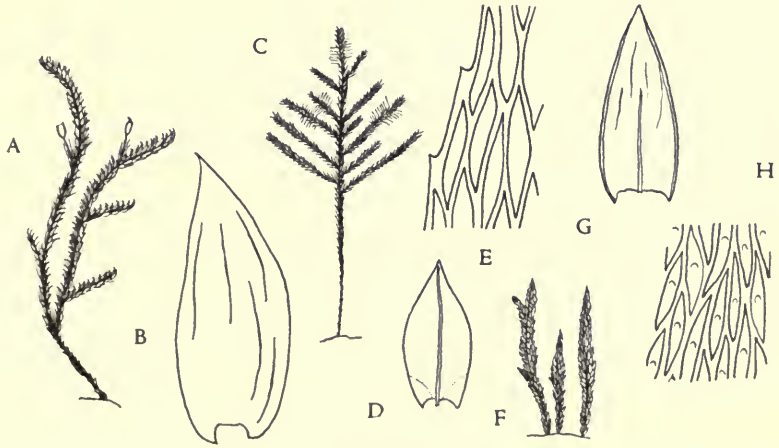

FIGURE 110

A–B, *Leucodon curvirostris:* A, plant, ×1; B, leaf, ×14.

C–E, *Pseudocryphaea flagellifera:* C, plant, ×1; D, leaf, ×14; E, upper leaf cells and margin, ×270.

F–H, *Leucodontopsis floridana:* F, plant, ×1; G, leaf, ×14; H, upper leaf cells, ×270.

back above, rounded, sinuose and incrassate in 10–12 rows at basal angles. Sporophyte not seen. (Fig. 110, C–E.)

Dept. Peten: *Lundell 2220, 2224.* Dept. Izabal: *Standley 72518a.* Dept. Escuintla: *Aguilar 1720.*

Distribution: Florida, West Indies, Central and South America.

On trees at low altitudes. The longer branched stems, plane margined leaves and the conspicuous microphyllous branchlets readily separate this species from *Leucodontopsis floridana.*

3. LEUCODONTOPSIS Ren. & Card., Bull. Soc. Roy. Bot. Belg. **32**: 177. 1893.

Medium sized plants growing in lax tufts. Primary stems creeping; secondary stems suberect, julaceous, simple or sparingly branched. Leaves crowded, plicate, short pointed; margins revolute; costa single to above mid-leaf; cells narrow, papillose. Sporophyte unknown.

1. LEUCODONTOPSIS FLORIDANA (Aust.) E. G. Britt., Bryol. **15**: 28. 1912.

Neckera (*Pilotrichum?*) *floridana* Aust., Bot. Gaz. **4**: 152. 1879.
Leucodontopsis plicata Ren. & Card., Bull. Soc. Roy. Bot. Belg. **32**: 177. 1893.

Plants pale green or brownish, not glossy; secondary stems to 2 cm. long. Leaves imbricated, 1.5–2 mm. long, ovate-lanceolate, plicate, concave, acute; margins strongly revolute nearly to apex, denticulate at point; costa faint; cells linear, vermicular, papillose on both sides, irregularly quadrate or transversely elongated in a large, conspicuous group at basal angles. Septate propagula often occur in the leaf axils. (Fig. 110, F–H.)

Dept. Peten: *Lundell 2220.*

Distribution: Florida, Mexico, British Honduras, Costa Rica, Panama, West Indies, South America.

On tree trunks at low altitudes. The habit, revolute leaf margins and distinctly papillose leaf cells are sharp diagnostic characters.

EXCLUDED SPECIES

FORSSTROEMIA PYCNOTHALLODES (C. M.) Par., Ind. Bryol. Suppl. 167. 1900.

DUSENIA PYCNOTHALLODES C. M., Hedwigia **36**: 107. 1897.

No authentic material of this species is available.

28. PRIONODONTACEAE

Dioicous; robust green plants growing in lax, deep tufts. Secondary stems simple or freely branched. Leaves fragile, the tips often broken off, lanceolate from an ovate base, coarsely toothed above; costa strong; cells oval, unipapillate, differentiated at basal angles in many rows. Seta short; capsules exserted, erect; peristome double.

1. PRIONODON C. M., Bot. Zeit. **1844**: 129. 1844.

Plants with the characters of the family.

Plants brown, cells of basal leaf angles elongated, lumens 1:4 or 6. 1. *P. fusco-lutescens*
Plants green, cells of basal angles short, 1:1 or 2.....2. *P. densus*

1. PRIONODON FUSCO-LUTESCENS Hampe, Ann. Sci. Nat. Ser. 5, **4**: 356. 1865.

Secondary stems 8–15 cm. long, simple or forked, yellowish at tips, brown below. Leaves crowded, the upper laxly erect when dry, widely spreading when moist, 7–9 mm. long, gradually lanceolate from an ovate, plicate, decurrent base, subulate-acuminate, the slender points very fragile, distantly serrate above; costa ending near apex; upper cells irregular, oblong or oval, mostly longer than wide, moderately incrassate, unipapillate, basal cells linear with sinuose lateral walls, at basal angles 4–6 times as long as wide with very narrow, elongated, sinuose lumens. "Capsule shortly exserted; lid obliquely rostrate; peristome teeth narrow, segments narrow, sinuate on margins." Sporophyte not seen. (Fig. 111, A–C.)

Dept. Huehuetenango: *Steyermark 48484, 50077.* Dept. San Marcos: *Standley 86216, 86439, 86455.* Dept. Chimaltenango: *Standley 57826, 58741b, 58744, 60954* in part, *61111, 61115a, 61953.* Dept. Guatemala: *Standley 80723.*

Distribution: Costa Rica, Colombia.

On trees and wet banks at high altitudes. Distinguished almost at a glance from *P. densus* by the more robust stems, brown in color with pale yellowish tips, and under a microscope by the distinctive cells at the basal leaf angles.

2. PRIONODON DENSUS (Hedw.) C. M., Bot. Zeit. **2**: 129. 1844.
Hypnum densum Hedw., Sp. Musc. 282. 1801.

Plants green or yellowish green; secondary stems 4–25 cm. long, simple or subpinnately branched. Leaves erect-spreading when

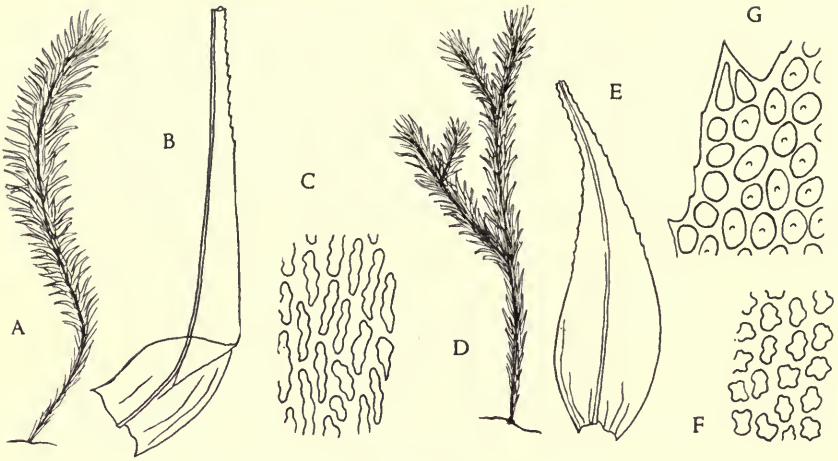

FIGURE 111

A–C, *Prionodon fusco-lutescens:* A, plant, ×1; B, leaf, ×8; C, cells at basal leaf angle, ×270.

D–G, *Prionodon densus:* D, plant, ×1; E, leaf, ×8; F, cells at basal leaf angle, ×270; G, upper leaf cells and margin, ×270.

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moist, to 6–7 mm. long, linear-lanceolate from an ovate, plicate base, acuminate, often undulate when dry, coarsely and irregularly serrate to below middle; costa ending below apex; upper cells small, irregularly hexagonal, usually unipapillate, inner basal cells linear, many rows toward basal angles small, short, rounded or wider than long, with angular, incrassate, porose walls. Sporophyte not seen. (Fig. 111, D–G.)

Dept. Alta Verapaz: *Standley 90766.* Dept. Huehuetenango: *Steyermark 50656.* Dept. San Marcos: *Standley 86209, 86295; Steyermark 35644, 35815, 35882, 36766.* Dept. Quezaltenango: *Standley 84297a, 84930, 84975, 84990, 85073, 85705; Steyermark 34693, 34726.* Dept. Sacatepequez: *Standley 65090a.* Dept. Solola: *Steyermark 46952, 47014, 47239, 47566.* Dept. Chimaltenango: *Standley 60035, 60954* in part, *61836a.* Dept. Guatemala: *Standley 58404, 80731.* Dept. Zacapa: *Steyermark 43309.* Dept. Chiquimula: *Steyermark 30612, 30781, 30819, 30820.* Dept. Jalapa: *Steyermark 32620.*

Distribution: Mexico, West Indies, Central and South America.

On trees at medium to high altitudes. A very variable species in size and habit but usually easily distinguished from *P. fusco-lutescens* by the greenish coloration, more slender and more freely branched stems, shorter and more strongly toothed leaves and the larger area of short, isodiametrical cells at the basal leaf angles. Where there is an abundance of moisture the species seems to culmi-

nate in a pendulous form with more elongated, much branched stems which may be designated as follows:

var. LUTEOVIRENS (Tayl.) Bartr., *comb. nov.*

Neckera luteovirens Tayl., Lond. Journ. Bot. **1846**: 59. 1846.

Stems pendulous, 20–25 cm. long, subpinnately branched.

Dept. San Marcos: *Steyermark 35865.* Dept. Solola: *Steyermark 47520.* Dept. Chimaltenango: *Standley 58793. 60958, 61104, 61826, 61922a, 61924a, 61929, 61952.* Dept. Jalapa: *Steyermark 32642.*

Distribution: Costa Rica, Colombia, Ecuador.

On trees at high altitudes. There seems to be no structural character peculiar to this form and I doubt that it is anything more than a luxuriant form in which environmental conditions have produced numerous intergrading phases.

29. TRACHYPODACEAE

Dioicous; moderately robust plants, tufted; primary stems filiform, creeping, secondary stems decumbent, branched, densely foliate. Leaves lanceolate; costa single; cells elongate, obscure, papillose. Sporophyte lateral; seta elongate; capsules erect; peristome double.

Leaf cells oval, with 1 or 2 papillae over lumens.....1. *Trachypodopsis*
Leaf cells linear, with numerous papillae along lateral walls.....2. *Trachypus*

1. TRACHYPODOPSIS Fleisch., Hedwigia **45**: 64. 1905.

Robust plants with a rufous tinge growing in dense masses. Secondary stems irregularly pinnate. Leaves crowded, plicate, serrulate, auriculate at base; costa ending below apex; cells elliptical, usually unipapillate over lumens, linear and smooth at base. Seta papillose; capsule erect; peristome double, segments of endostome shorter than teeth, from a low basal membrane; lid short, oblique, conic-rostrate; calyptra cucullate, naked or sparsely pilose.

1. TRACHYPODOPSIS OTIOPHYLLA (Card.) Card., Rev. Bryol. **38**: 39. 1911.

Prionodon otiophyllus Card., Rev. Bryol. **37**: 7. 1910.

Secondary stems to 4 or 5 cm. long, densely matted or tufted, pale tawny green, slightly glossy, with numerous lateral branches,

widely spreading when moist. Stem leaves crowded, laxly erect with strongly undulate, crispate points when dry, to 4 mm. long, gradually ligulate-lanceolate from an ovate, plicate, auriculate base; margins serrulate all around; costa ending below apex; cells narrowly oval or rhomboidal, with 1 or 2 small papillae over lumens, narrower and elongate toward margins, basal cells linear with sinuose lateral walls, small and irregularly rounded in auricles. Branch leaves smaller. Fruit unknown. (Fig. 109, D–F.)

Dept. Huehuetenango: *Sharp 4901.*

Distribution: Mexico.

On log at moderately high altitude. In vegetative features these plants differ little if any from the widespread *T. crispatula* (Hook.) Fleisch. of southeastern Asia and Malaysia. Unless there is some distinction in the sporophyte I doubt if they can be separated.

2. TRACHYPUS Reinw. & Hornsch., Nov. Act. Acad. Leop. Carol. **14**[2] Suppl.: 708. 1829.

Plants with the characters of the family. Leaf cells minutely and densely papillose on lateral walls. Seta papillose; calyptra pilose.

1. TRACHYPUS VIRIDULUS (Mitt.) Broth., E. & P. Pflanzenf. **1**[3]: 830. 1906.

Meteorium viridulum Mitt., Journ. Linn. Soc. **12**: 443. 1869.

Plants growing in dense, feathery tufts, dull green or yellowish at tips, brown or black below; secondary stems 4–6 cm. long, subpinnately branched. Leaves crowded, flexuous-spreading when dry, 2.5–3 mm. long, rather abruptly linear-lanceolate from a short, broadly ovate base, subulate-acuminate, plicate; margins denticulate, inflexed at base; costa faint, ending above mid-leaf; cells linear, obscure, with numerous small, closely spaced papillae along the lateral walls, pellucid and smooth near base. Sporophyte not seen. (Fig. 112, A–C.)

Dept. Alta Verapaz: *Standley 71091.* Dept. Solola: *Standley 62361.* Dept. Chimaltenango: *Standley 58781, 80171.*

Distribution: Costa Rica, Cuba, Ecuador.

On trees at medium to high altitudes. The peculiarly shaped leaves and the characteristic areolation clearly differentiate this species from any other tropical American moss. No fruiting plants have ever been collected to my knowledge.

30. PTEROBRYACEAE

Plants mostly robust and often dendroid or frondose in habit. Secondary stems often from a woody, stipitate base. Leaves spreading on all sides; costa single or double and short; cells elongate incrassate, porose, usually smooth. Seta rather short; capsules erect, immersed or exserted, smooth; peristome double, endostome generally rudimentary; lid short beaked; calyptra smooth, naked.

1. Costa short and double or lacking 2
   Costa single 3
2. Branch leaves spirally seriate ..... 5. *Orthostichidium*
   Branch leaves not ranked ..... 4. *Renauldia*
3. Branch leaves strongly spirally seriate ..... 6. *Orthostichopsis*
   Leaves not or weakly ranked 4
4. Branches subterete, leaves concave and closely imbricated ... 3. *Pterobryopsis*
   Leaves spreading or squarrose 5
5. Leaves plicate, capsules immersed ..... 8. *Pterobryum*
   Leaves smooth, capsules exserted 6
6. Leaves erect-spreading, secondary stems branched ..... 7. *Pireella*
   Leaves squarrose-spreading, secondary stems simple 7
7. Leaves lanceolate ..... 1. *Jaegerina*
   Leaves broadly ovate ..... 2. *Jaegerinopsis*

1. JAEGERINA C. M., Linnaea **40**: 274. 1876.

Secondary stems simple or very sparingly branched. Leaves widely spreading, ovate-lanceolate; margins plane; costa single, slender; cells linear, smooth, alar group small. Seta slender, smooth; capsule erect; peristome simple; lid slenderly beaked.

1. JAEGERINA GUATEMALENSIS Bartr., Bryol. **49**: 116. 1946.

Rather robust, glossy, golden green plants growing in loose mats. Secondary stems simple, densely foliate, to 5 cm. long. Leaves squarrose-spreading moist and dry, scariose, to 5.5 mm. long, gradually lanceolate from a short, erect, broadly ovate, cordate base, keeled above; margins plane, minutely denticulate above the basal portion of the leaf; costa slender, ending in the subula; upper cells linear, often papillose at apical angles, gradually more elongate below, basal cells smooth, porose, alar group of subquadrate cells small and poorly defined. Seta erect, smooth, 8 mm. long; capsule elliptical, urn 2 mm. long, abruptly contracted to seta; lid erect,

slenderly beaked, 1.5 mm. long; peristome single, teeth evenly spaced, narrowly lanceolate, hyaline, minutely papillose, about 225 μ high; spores brown, diameter 15 μ. (Fig. 112, D–F.)

Dept. Izabal: Between Bananera and "La Prensa" in Montana del Mico, alt. 50–100 m., *Steyermark 38205, 39202* TYPE; northeast of San Felipe, alt. 50–100 m., *Steyermark 39648.*

Endemic.

A very interesting addition to the Central American moss flora. *J. jamaicensis* E. G. Britt., the only other species recorded from North America, is quite different, as it has shorter stems and more erect-spreading leaves of a very different shape.

2. JAEGERINOPSIS Broth., E. & P. Pflanzenf. **1**[3]: 790. 1906.

Plants similar in habit to *Jaegerina* but with the leaves broadly ovate.

Costa single, to above mid-leaf.....2. *J. squarrosa*
Costa double and short.....1. *J. scariosa*

1. JAEGERINOPSIS SCARIOSA (Lor.) Broth., E. & P. Pflanzenfam. **1**[3]: 791. 1906.

Meteorium scariosum Lor., Moost. 165. 1864.

Plants similar in habit and appearance to *J. squarrosa.* Leaves however ecostate or with a very short, double costa. Sporophyte lateral; perichaetial leaves convolute-clasping, erect, acuminate, about half as long as seta; seta stout, erect, 4 mm. long; capsule oblong-cylindrical, urn brown, 2.5 mm. long; peristome teeth short, bluntly pointed, smooth. (Fig. 109, G.)

Dept. Baja Verapaz: *Sharp 2665a.*

Distribution: Costa Rica, Panama.

On tree trunk at low altitude. The leaves of these plants are uniformly shortly bicostate or even ecostate; hence there is no alternative but to refer them to *J. scariosa.* Many of the plants show well matured fruit, so the collection has an important potential value. Steere has recorded this species from Peten (*Lundell 2044*).

2. JAEGERINOPSIS SQUARROSA E. G. Britt., Bryol. **21**: 48. 1918.

Secondary stems loosely tufted, yellowish green, 2–4 cm. long, unbranched. Leaves crowded, widely spreading, 2–3 mm. long, to

1.5 mm. wide, broadly ovate from a subcordate base, short acuminate, carinate-concave, minutely serrulate all around; costa single, often ending above mid-leaf, rarely short and double; cells linear, smooth, laxer and colored across insertion, scarcely differentiated at basal angles. Sporophyte unknown. (Fig. 112, G–I.)

Dept. Peten: *Lundell 2037.*

Distribution: Florida, Cuba.

On tree at low altitude. The distinctions between Jaegerina and Jaegerinopsis seem to be trivial from a generic standpoint and I suspect that Jaegerina could well be used for both groups.

3. PTEROBRYOPSIS Fleisch., Hedwigia **45**: 56. 1905.

Medium sized plants growing in lax colonies or tufts; secondary stems branched, densely foliate. Leaves concave, ovate; costa single or lacking; cells elongate, smooth, differentiated at basal angles. Capsules exserted on a fairly long seta; calyptra cucullate.

1. PTEROBRYOPSIS MEXICANA (Schimp.) Fleisch., Hedwigia **45**: 60. 1905.

Cryptotheca mexicana Schimp. ms. in herb.

Garovaglia mexicana Ren. & Card., Bull. Soc. Roy. Bot. Belg. **38**: 226. 1899.

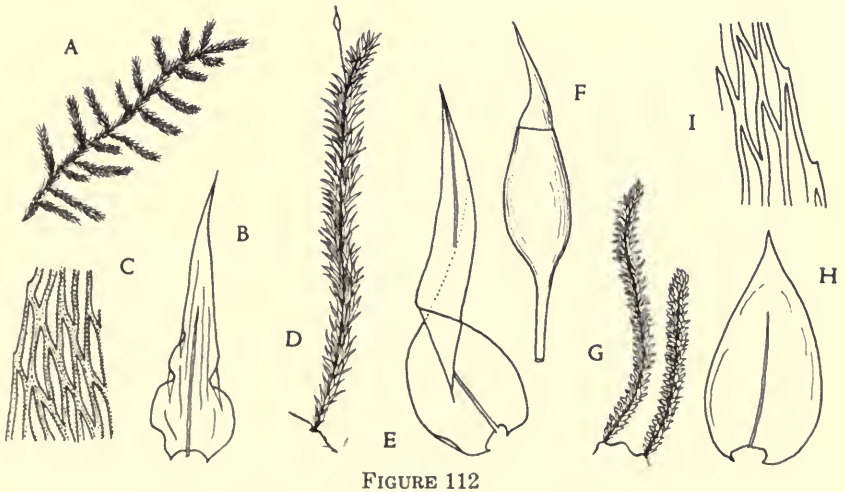

FIGURE 112

A–C, *Trachypus viridulus:* A, part of plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270.

D–F, *Jaegerina guatemalensis:* D, plant, ×1; E, leaf, ×8; F, capsule, ×8.

G–I, *Jaegerinopsis squarrosa:* G, plant, ×1; H, leaf, ×12; I, upper leaf cells and margin, ×270.

Plants rigid, yellowish green, slightly glossy; secondary stems erect, 6–8 cm. high, irregularly pinnate above, branches subjulaceous. Branch leaves crowded, laxly imbricated when dry, 1.5–2 mm. long, ovate, short acuminate, denticulate toward apex; costa faint, ending above mid-leaf; cells linear-rhomboidal, incrassate, subquadrate in 15–20 rows at basal angles forming a large but not sharply differentiated group. Sporophyte not seen. (Fig. 113, A–C.)

Dept. Sacatepequez: *Standley 63730.* Dept. Chimaltenango: *Standley 81074a.* Dept. Jalapa: *Standley 77500a.*

Distribution: Mexico, Costa Rica.

On trees at medium altitudes. The dendroid habit and the concave, nerved, not ranked, closely imbricated leaves make this species easy of recognition.

4. RENAULDIA C. M., in Ren., Prodr. Fl. Bryol. Madag. 189. 1897.

Plants yellowish green, laxly tufted; secondary stems dendroid, branched. Leaves deeply concave, short pointed; costa none or very short and double; cells linear, smooth. Perichaetium large; capsules immersed; peristome double, endostome rudimentary in our species; lid conic-rostrate.

1. RENAULDIA COCHLEARIFOLIA (Hornsch.) Broth., E. & P. Pflanzenf. Ed. 2, **11**: 146. 1925.

Cryptotheca cochlearifolia Hornsch., in Deppe & Schiede, Musc. Mex.

Pilotrichum cochlearifolium C. M., Syn. **2**: 182. 1851.

Meteorium mexicanum Mitt., Journ. Linn. Soc. **12**: 433. 1869.

Secondary stems robust, pinnately branched, 4–8 cm. long, branches widely spreading. Leaves crowded, closely imbricated, deeply concave, 2–3 mm. long, oblong-ovate from a subcordate base, abruptly short pointed, entire; costa double, very short; cells linear, shorter, laxer, and yellowish across insertion, differentiated alar cells few and inconspicuous. Perichaetial leaves 4 mm. long, ovate-lanceolate, narrowed to a linear, acuminate, denticulate point; capsule immersed on a very short seta, oblong, 1.5 mm. long; lid 0.4 mm. long; annulus broad; peristome teeth linear-lanceolate, hyaline, smooth; spores oval-oblong, 25–45 μ, minutely papillose. (Fig. 113, D–E.)

Dept. Quezaltenango: *Steyermark 33941, 33943a, 34232a.* Dept. Sacatepequez: *Standley 63711b.* Dept. Chimaltenango: *Standley 80167a.*

Distribution: Mexico.

On tree trunks at medium to high altitudes. The nearly ecostate leaves, inconspicuous alar cells and the deeply cucullate leaf apex are good diagnostic characters.

5. ORTHOSTICHIDIUM C. M., in K. Sv. Vet.-Akad. Handl. **28**[2]: 19. 1895.

Laxly tufted, glossy, golden green plants; secondary stems irregularly pinnate. Leaves imbricated, concave, ecostate; cells linear, poorly differentiated at basal angles. Capsules immersed; peristome teeth smooth, narrow, endostome lacking; lid short, conic-rostrate.

1. ORTHOSTICHIDIUM PENTAGONUM (Hampe & Lor.) C. M., Bull. Herb. Boiss. **5**: 205. 1897.

Pilotrichum pentagonum Hampe & Lor., Bot. Zeit. 28. 1869.

?Orthostichidium subtetragonum C. M., Bull. Herb. Boiss. **5**: 205. 1897.

Secondary stems 4–6 cm. long, branches spreading. Leaves imbricated, usually in distinct spiral rows on the branches, 1.5–1.8 mm. long, oblong-ovate, abruptly short acuminate, ecostate, entire; margins broadly inflexed above; cells very long and narrow, in-

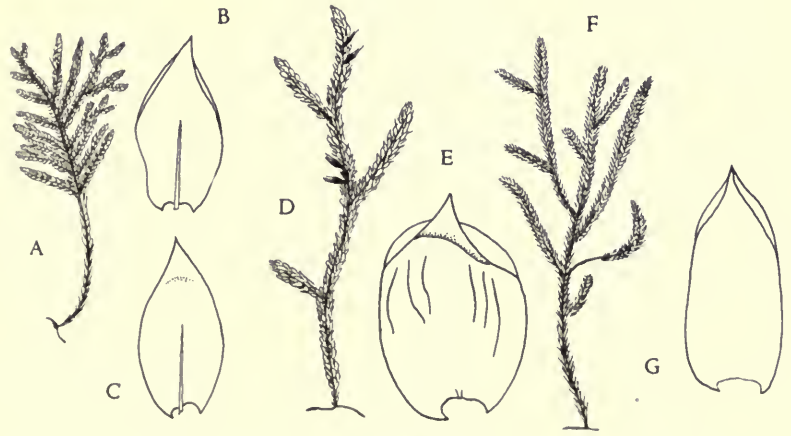

FIGURE 113

A–C, *Pterobryopsis mexicana:* A, plant, ×1; B and C, leaves, ×14.
D–E, *Renauldia cochlearifolia:* D, plant, ×1; E, leaf, ×14.
F–G, *Orthostichidium pentagonum:* F, plant, ×1; G, leaf, ×16.

crassate, shorter and colored across insertion, scarcely differentiated at basal angles. Seta very short; capsule immersed. (Fig. 113, F–G.)

Dept. Escuintla: *Standley 63393.*

Distribution: Mexico, Costa Rica, Ecuador.

On tree at moderate altitude. The distinctions Muller draws between *O. pentagonum* and *O. subtetragonum* are not convincing and I imagine they will fail to hold in a critical comparison. *O. pentagonum* will be readily separated from *Pterobryopsis mexicana* by the ecostate leaves and from *Renauldia cochlearifolia* by the spirally ranked branch leaves with the margins inflexed above. Apparently *O. excavatum* Mitt. and *O. pentagonum* are identical, but as both species were published in 1869 I am not sure which name has priority.

6. ORTHOSTICHOPSIS Broth., E. & P. Pflanzenf. 1^3: 804. 1906.

Rather robust golden green or brownish plants; secondary stems numerous, elongated, pinnately branched. Leaves concave, erect or imbricated in spiral rows; costa single, ending about mid-leaf; cells linear, small and rounded in a well defined alar group. Seta short; capsules immersed in our species; peristome teeth narrow, smooth, endostome rudimentary.

1. ORTHOSTICHOPSIS TETRAGONA (Hedw.) Broth., E. & P. Pflanzenf. 1^3: 805. 1906.

Hypnum tetragonum Hedw., Sp. Musc. 246. 1801.

Secondary stems pendulous in tangled masses, 8–10 cm. long, generally distantly pinnate, branches divergent. Stem leaves appressed, not seriate, oblong-ovate, abruptly contracted to a long, linear-subulate point; branch leaves distinctly imbricated in 5 spiral rows, 2 mm. long, oblong-ovate, plicate, abruptly short mucronate; margins denticulate above; costa slender, ending well above mid-leaf; cells linear, shorter and colored across insertion, small, rounded and incrassate in a rather large, well defined alar group. Seta very short; capsule immersed. (Fig. 114, A–C.)

Dept. Peten: *Steyermark 46023, 46167; Bartlett 12442.* Dept. Izabal: *Steyermark 38737, 38899, 39778, 41739, 41745.* Dept. Alta Verapaz: *Steyermark 45651, 45678.*

Distribution: Mexico, West Indies, Central and South America.

Pendulous from limbs and branches of trees at low altitudes. Often quite slender and variable in branching but easily recognized by the seriate, short pointed, plicate branch leaves.

7. PIREELLA Card., Rev. Bryol. **40**: 17. 1913.

Dioicous; secondary stems branched above from a simple, stipe-like base. Upper stem and branch leaves imbricated, ovate-lanceolate; costa single, strong; cells oval or elongate, alar group often well differentiated. Capsules generally exserted, erect; peristome double, teeth often in pairs, smooth, endostome rudimentary, adherent to teeth; lid beaked; calyptra cucullate, pilose when young.

1. Leaves falcate-secund, ligulate from an ovate base.....5. *P. falcifolia*
   Leaves erect-spreading, ovate-lanceolate.....2
2. Upper and median leaf cells narrow, elongate.....1. *P. cymbifolia*
   Upper and median leaf cells short, oval.....3
3. Seta smooth, short alar cells very numerous.....2. *P. pachyclada*
   Seta scabrous above, short alar cells few.....4
4. Capsules subglobose.....3. *P. Mariae*
   Capsules oblong-cylindrical.....4. *P. guatemalensis*

1. PIREELLA CYMBIFOLIA (Sull.) Card., Rev. Bryol. **40**: 17. 1913.

Pilotrichum cymbifolium Sull., Mosses U. S. 81. 1856.

Plants growing in lax green tufts; secondary stems 2–5 cm. or more high, irregularly branched or subpinnate. Branch leaves

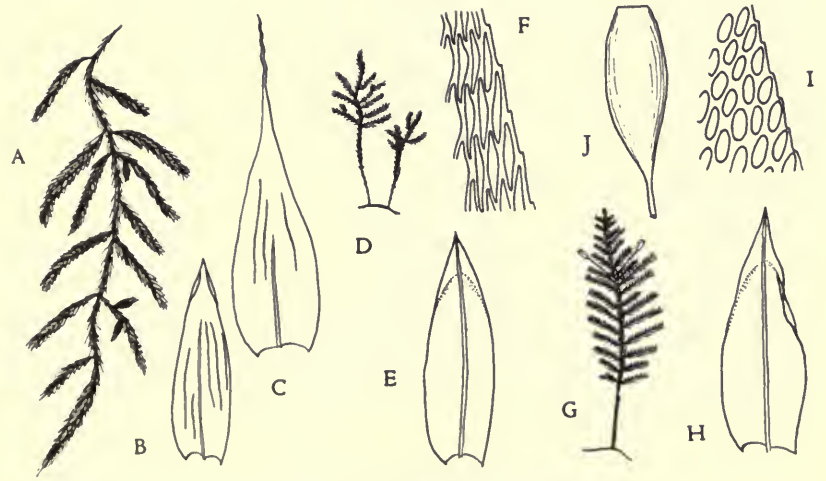

FIGURE 114

A–C, *Orthostichopsis tetragona:* A, part of plant, ×1; B, branch leaf, ×14; C, stem leaf, ×14.

D–F, *Pireella cymbifolia:* D, plant, ×1; E, leaf, ×26; F, upper leaf cells and margin, ×270.

G–J, *Pireella pachyclada:* G, plant, ×1; H, leaf, ×26; I, upper leaf cells and margin, ×270; J, capsule, ×8.

crowded, erect-spreading, sometimes spirally ranked, to 1.5 mm. long, oblong-lanceolate, concave, short acuminate; margins serrulate nearly to base; costa percurrent; cells linear, slightly vermicular, sometimes papillose on back, shorter and colored at extreme base, subquadrate in a small area at basal angles. Seta 8–10 mm. long; capsule ovoid-cylindric. (Fig. 114, D–F.)

Dept. Peten: *Bartlett 12472a, 12493a; Lundell 2041, 2043.* Dept. Alta Verapaz: *Steyermark 44995b.*

Distribution: Southeastern United States, Mexico, British Honduras, Cuba.

On trees and logs at low altitudes. Variable in habit and branching but readily segregated by the linear leaf cells.

2. PIREELLA PACHYCLADA (Ren. & Card.) Card., Rev. Bryol. **40**: 18. 1913.

Pirea pachyclada Ren. & Card., Bull. Soc. Roy. Bot. Belg. **41**: 67. 1904.

Plants dull green; secondary stems 3–4 cm. high, erect, dendroid, pinnately branched forming an oblong frond. Leaves 1–1.5 mm. long, oblong-ovate from a cordate base, concave, short acuminate, often spirally imbricated on the branches; margins minutely crenulate toward apex; costa ending in or near apex; cells small, oval, incrassate, smooth, linear at extreme base toward costa, subquadrate and numerous in many rows at basal angles. Seta 4–5 mm. long, smooth; capsule oblong-cylindric, urn 2–2.5 mm. long. (Fig. 114, G–J.)

Dept. Peten: *Lundell 2849, 2942; Bartlett 12265, 12486.* Dept. Alta Verapaz: *Steyermark 45587.*

Distribution: Mexico.

On trees and rocks at low altitudes. The shorter oval upper and median leaf cells distinguish this species from *P. cymbifolia*. *P. Mariae* differs in the unlike stem and branch leaves, the much smaller area of small alar cells, the setae, which are scabrous above, and the subglobose capsules.

3. PIREELLA MARIAE (Card.) Card., Rev. Bryol. **40**: 18. 1913.

Pirea Mariae Card., Bull. Soc. Roy. Bot. Belg. **32**: 176. 1893.

Secondary stems 2–6 cm. high, dendroid, bipinnately branched above from a long, simple, stipe-like base. Upper stem leaves 2–2.2 mm. long, ovate-lanceolate from a subcordate base, slenderly

acuminate, entire. Branch leaves smaller, 1–1.2 mm. long, ovate-lanceolate, concave, short acuminate, minutely serrulate above; costa ending below apex; upper and median cells oval, incrassate, smooth, linear near costa at base, subquadrate alar cells few and inconspicuous. Seta slender, 6–10 mm. long, scabrous above; capsule subglobose, small mouthed, urn 2 mm. long; lid slenderly beaked, 1.5 mm. long; peristome teeth pale, cleft along median line, endostome rudimentary, adherent to teeth. (Fig. 115, A–D.)

Dept. Izabal: *Steyermark 41890.*

Distribution: Costa Rica.

On trees at low altitudes. This is a noteworthy collection as the species was previously known only from Costa Rica.

4. PIREELLA GUATEMALENSIS (Williams) Bartr., Bryol. **49**: 116. 1946.

Thamnium guatemalense Williams in herb.

Secondary stems to 5 cm. high, dull yellowish green, densely and irregularly branched above in a rather ragged frond from an elongate, stipitate base. Stipe leaves minute, squarrose-spreading, abruptly short acuminate from a broad, short, clasping base. Upper stem leaves erect-spreading, broadly ovate, acuminate, 1.5 mm. long,

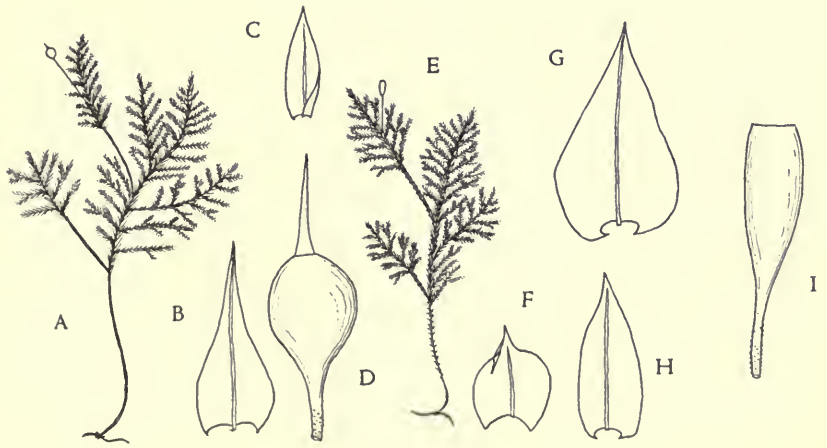

FIGURE 115

A–D, *Pireella Mariae:* A, plant, ×1; B, stem leaf, ×12; C, branch leaf, ×12; D, capsule, ×8.

E–I, *Pireella guatemalensis:* E, plant, ×1; F, stipe leaf, ×16; G, stem leaf, ×16; H, branch leaf, ×16; I, capsule, ×8.

1 mm. wide; margins plane, denticulate above; costa slender, ending below apex; cells smooth, incrassate, irregularly oval above, to 15 μ long, gradually becoming linear below, shorter and brownish across the insertion, short alar cells few, inconspicuous. Branch leaves somewhat smaller and narrower. Perichaetium large, inner leaves long and slenderly acuminate; seta erect, 5 mm. long, scabrous above, smooth below; capsule erect, oblong-ovate, brown, urn about 2 mm. long; operculum erect, conic-rostrate. (Fig. 115, E–I.)

Dept. Alta Verapaz: Finca Mocca, *Harry Johnson 154* in part, TYPE.

Distribution: Mexico.

Similar in habit and appearance to *P. Mariae* but sharply distinct in the squarrose stipe leaves, shorter setae and oblong-ovate capsules. Mr. Donald Richards found the specimen in Mr. R. S. Williams' personal herbarium under the name of *Thamnium guatemalense* Williams and kindly lent it to me for study.

5. PIREELLA FALCIFOLIA Bartr., Bryol. **49**: 117. 1946.

Secondary stems erect, dendroid, brownish, not glossy, to 5 cm. high, forming a dense, oblong frond from a short, stipitate base. Stipe leaves scale-like, appressed. Upper stem leaves erect-spreading, crowded, 5 mm. long, rather quickly ligulate-lanceolate from an ovate base, acuminate; margins plane, denticulate toward apex; costa brownish, ending some distance below apex; cells linear, rather short, incrassate, smooth, shorter, porose and brownish at extreme base, alar cells few, small and subquadrate. Branch leaves smaller, scarcely 3 mm. long, narrower and more broadly pointed, carinate, clearly falcate-secund both moist and dry, apical cells oval-rhomboidal. Fruit unknown. (Fig. 116, A–D.)

Dept. Zacapa: Cloud forest in ravine bordering Quebrada Alejandria, summit of Sierra de las Minas, vicinity of Finca Alejandria, alt. 2,500 m., *Steyermark 29868*.

Endemic.

On tree trunk. This striking species is suggestive of *Pterobryum angustifolium* in a general way but is clearly different in the appressed stipe leaves and the falcate-secund branch leaves narrowed to a ligulate point. Its generic position is problematical. Until the sporophyte is available I have tentatively placed it in *Pireella*.

8. PTEROBRYUM Hornsch., Fl. Bras. **1**: 50. 1840.

Robust, green or yellowish green frondose plants; secondary stems closely pinnate above from a stipe-like base. Leaves crowded,

erect-spreading, ovate-lanceolate, plicate; costa single; cells linear, smooth, scarcely differentiated at basal angles. Capsules immersed; peristome teeth narrow, smooth, endostome rudimentary, adherent to teeth; lid short, conical; calyptra small, mitriform, naked.

Stipe leaves appressed, leaves strongly plicate.....1. *P. densum*
Stipe leaves squarrose, leaves plicate only near base.....2. *P. angustifolium*

1. PTEROBRYUM DENSUM (Schwaegr.) Hornsch., Fl. Bras. **1**: 50. 1840.

Pterogonium densum Schwaegr., Suppl. 3, 1²: t. 243. 1828.

Secondary stems robust, 4–8 cm. high, branched, forming a triangular frond. Stipe leaves appressed, scale-like. Frond leaves crowded, erect-spreading, ovate-lanceolate, strongly plicate, 2–3 mm. long; margins plane, serrate in upper half; costa ending below apex; cells linear-rhomboidal, shorter, colored and incrassate near insertion. Perichaetial leaves lanceolate, subulate-acuminate, entire; capsule ovoid, urn 2 mm. long; lid short beaked. (Fig. 116, E–G.)

Dept. San Marcos: *Steyermark 36485, 36767.* Dept. Quezaltenango: *Standley 67886.* Dept. Suchitepequez: *Steyermark 46661, 46663a.* Dept. Solola: *Steyermark 47356.*

Distribution: Mexico, Central and South America.

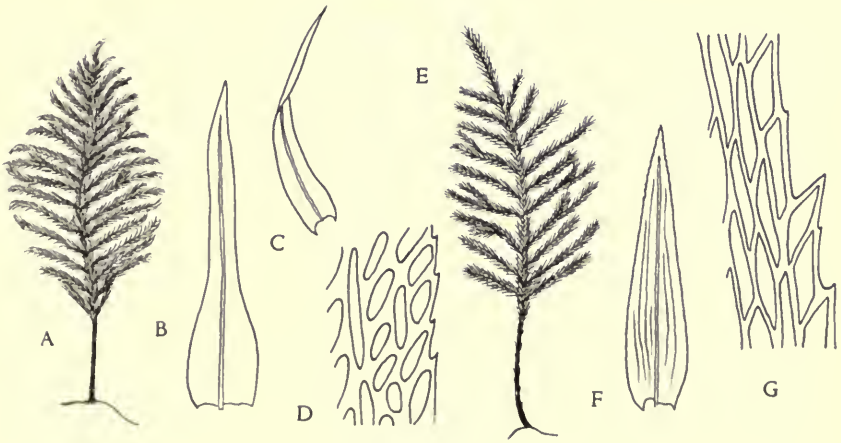

FIGURE 116

A–D, *Pireella falcifolia:* A, plant, ×1; B, stem leaf, ×8; C, branch leaf, ×8; D, upper leaf cells and margin, ×270.

E–G, *Pterobryum densum:* E, plant, ×1; F, leaf, ×16; G, upper leaf cells and margin, ×270.

On trees at medium to high altitudes. A conspicuous moss readily known by the frondose habit and the strongly plicate leaves.

2. PTEROBRYUM ANGUSTIFOLIUM (C. M.) Mitt., Journ. Linn. Soc. **12**: 426. 1869.

Pilotrichum angustifolium C. M., Syn. **2**: 181. 1851.

Less robust than *P. densum;* secondary stems 3–4.5 cm. long, branched above the short, stipe-like base forming a dense, oblong frond. Stipe leaves squarrose-recurved. Frond leaves erect-spreading, about 2 mm. long, lanceolate from a broadly ovate base, faintly plicate only below; margins plane, minutely serrulate nearly all around; costa percurrent; cells linear, shorter and colored across insertion. Perichaetium conspicuous, inner leaves oblong-lanceolate, costa excurrent in a long, denticulate arista; capsule ovoid, immersed, urn 2 mm. long; lid conic-apiculate. (Fig. 117, A–C.)

Dept. Peten: *Lundell 2041, 2867.* Dept. Izabal: *Steyermark 38892, 39911.*

Distribution: Honduras, Costa Rica, West Indies, Colombia.

On trees at low altitudes. Evidently a lowland species differing markedly from *P. densum* in the squarrose stipe leaves and nearly smooth frond leaves with the costa percurrent. It is more likely to be mistaken for a *Pireella.*

31. METEORIACEAE

Plants slender to robust; primary stems creeping, filiform, secondary stems elongate, usually pendent in intricate masses, freely branched, densely foliate. Leaves ovate-lanceolate, acuminate; costa single or lacking; cells elongate, often papillose. Capsules usually exserted on short, slender setae; peristome double; lid short; calyptra often pilose.

1. Costa single.....2
   Costa short and double or none.....6
2. Alar cells distinct in a small, well defined group.....1. *Squamidium*
   Alar cells poorly defined or none.....3
3. Leaf cells papillose over lumens.....4
   Leaf cells smooth or papillose only at apical angles.....5
4. Upper leaf cells obscure, pluripapillate.....3. *Papillaria*
   Upper leaf cells distinct, unipapillate.....4. *Meteorium*
5. Secondary stems not elongate or pendulous, leaves divaricately spreading 5. *Lindigia*
   Secondary stems elongate, pendulous, leaves erect-spreading...7. *Meteoriopsis*
6. Leaves deeply concave, short pointed.....2. *Pilotrichella*
   Leaves not concave, filiform acuminate.....6. *Barbella*

1. SQUAMIDIUM (C. M.) Broth., E. & P. Pflanzenf. 1[3]: 807. 1906.

Meteorium sect. *Squamidium* C. M., Linnaea **42**: 420. 1879–81.

Secondary stems numerous, irregularly pinnate, branches densely foliate, julaceous. Leaves imbricated, concave, oval, short pointed or filiform acuminate; costa slender, ending well below apex; cells linear, smooth, sharply differentiated at basal angles. Seta short; capsules immersed or shortly exserted; lid conic-rostrate; calyptra campanulate, lobed at base.

Leaves short apiculate ..... 1. *S. nigricans*

Leaves filiform acuminate ..... 2. *S. leucotrichum*

1. SQUAMIDIUM NIGRICANS (Hook.) Broth., E. & P. Pflanzenf. 1[3]: 808. 1906.

Hypnum nigricans Hook. in Kunth, Syn. Pl. Aeq. **1**: 64. 1822.

?Orthostichella anacamptacea C. M.?

Plants pale or yellowish green, tinged with brown or black, glossy; secondary stems to 8 or 10 cm. long, laxly and irregularly pinnate.

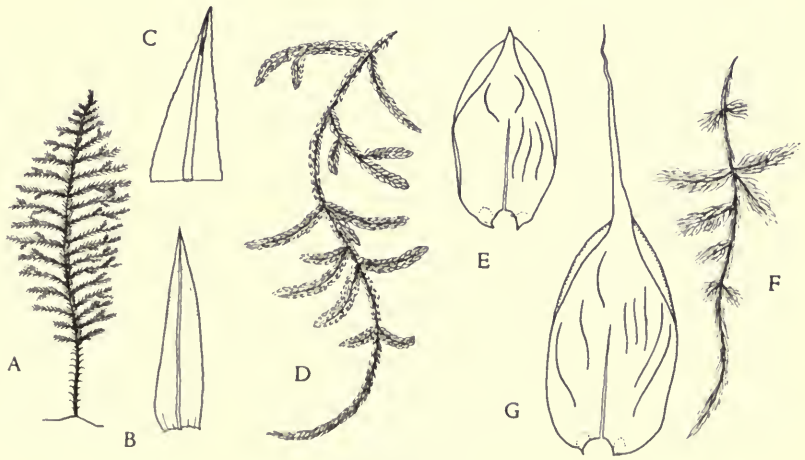

FIGURE 117

A–C, *Pterobryum angustifolium:* A, plant, ×1; B, leaf, ×16; C, apex of leaf, ×68.

D–E, *Squamidium nigricans:* D, part of plant, ×1; E, branch leaf, ×16.

F–G, *Squamidium leucotrichum:* F, part of plant, ×1; G, branch leaf, ×14.

Branch leaves deeply concave, closely imbricated, often in distinct spiral rows, 1–1.5 mm. long, broadly ovate, abruptly apiculate, serrulate above; costa faint, ending well below apex; cells narrowly linear, at basal angles subquadrate in a small, well defined group. Perichaetial leaves larger, ovate-lanceolate, subulate-acuminate; capsule immersed, ovoid. (Fig. 117, D–E.)

Dept. Alta Verapaz: *Standley 69971, 69982, 70546, 71021, 71046, 71070, 71091a, 71097, 90398, 90465, 90679a, 91808, 91810a, 92503; Steyermark 44623a.* Dept. San Marcos: *Standley 68616, 68922.* Dept. Quezaltenango: *Standley 85511b.* Dept. Guatemala: *Standley 58415b.* Dept. Baja Verapaz: *Standley 69917, 91155.* Dept. Chiquimula: *Steyermark 30521, 30595a, 30596a, 30600.*

Distribution: Mexico, throughout the West Indies, Central and South America.

On trees at medium altitudes. The nerved leaves will at once distinguish this species from *Pilotrichella*. Nos. 71070 and 71091a represent a form with slender, flagelliform branchlets which may be the equivalent of *S. filiferum* (C. M.) Broth. of Venezuela.

2. SQUAMIDIUM LEUCOTRICHUM (Tayl.) Broth., E. & P. Pflanzenf. 1^3: 809. 1906.

Hypnum leucotrichum Tayl., Lond. Journ. Bot. 7: 196. 1848.

Pilotrichella longipila Schimp., Ann. Sci. Nat. Ser. 6, 3: 214. 1876.

Secondary stems pendulous, to 30 cm. or more long, interruptedly pinnate, pale green at tips, brown or black below. Stem leaves laxly appressed, concave, ending in a long, crispate hair point. Branches turgid, short, bristling on all sides with the piliform leaf points; leaves about 4 mm. long over all, very concave, oblong from a cordate base, rather quickly narrowed to a long, flexuous, denticulate hair point; margins serrulate above, inflexed toward apex; costa slender, extending above mid-leaf; cells narrowly linear, at basal angles quadrate, incrassate in a sharply defined tumid group. Capsule immersed (sporophyte not seen). (Fig. 117, F–G.)

Dept. Alta Verapaz: *Standley 91366a.* Dept. Guatemala: *Standley 58459a.* Dept. Chiquimula: *Steyermark 30601a, 31439.*

Distribution: Costa Rica, West Indies, South America.

On trees at moderate altitudes. *Pilotrichella longipila* differs in no essential particular from the plants of Central and South America and should certainly be reduced to synonymy.

2. PILOTRICHELLA (C. M.) Besch., Prodr. Bryol. Mex. 78. 1871.

Neckera subsec. *Orthostichella* C. M., Syn. **2**: 123. 1851 in part and subsec. 2. *Pilotrichella* C. M., Syn. **2**: 129. 1851.

Glossy pendulous plants usually hanging in tangled masses; secondary stems elongate, distantly pinnate, branches tumid. Leaves imbricated, concave, ovate; costa lacking or short and double; cells linear, smooth, often differentiated at basal angles. Capsules ovoid, exserted on a rather short seta; peristome double, teeth papillose, segments of endostome narrowly linear; lid long beaked; calyptra cucullate, pilose.

Robust plants, alar cells in a round, sharply defined group.....2. *P. flexilis*

Slender plants, alar cells few, poorly defined, not colored.....1. *P. rigida*

1. PILOTRICHELLA RIGIDA (C. M.) Besch., Prodr. Bryol. Mex. 78. 1871.

Neckera rigida C. M., Syn. **2**: 126. 1851.

Orthostichella filamentosula C. M., Bull. Herb. Boiss. **5**: 204. 1897.

Secondary stems slender, from few to 25 or 30 cm. long, pale green, often tinged with brown, varying widely in size and habit. Leaves laxly imbricated, deeply concave, often clearly spirally ranked on the branches, 1–1.5 mm. long, oblong-ovate or subpanduriform, ecostate, abruptly short apiculate; margins serrulate all around, broadly inflexed above; cells linear, subquadrate in a small, poorly defined area at basal angles. Seta 4 mm. long; capsule exserted, oblong, urn 1 mm. long; lid obliquely rostrate, 1 mm. long. (Fig. 118, A–C.)

Dept. Izabal: *Steyermark 39991, 41766, 41792.* Dept. Alta Verapaz: *Standley 71207a*-(c. fr.), *71672, 91407, 91732; Steyermark 44288, 44297, 44571, 45072, 45084.* Dept. Huehuetenango: *Steyermark 49439.* Dept. San Marcos: *Standley 68616a, 68793a, 86522; Steyermark 36676.* Dept. Quezaltenango: *Standley 65433, 65434, 68140, 68261, 86670, 86702; Steyermark 33405, 33441, 34323, 34366.* Dept. Sacatepequez: *Standley 58113, 88951.* Dept. Suchitepequez: *Steyermark 46666.* Dept. Chimaltenango: *Standley 62018.* Dept. Guatemala: *Standley 58411, 58412, 58415, 80668.* Dept. Chiquimula: *Steyermark 30613, 31558.* Dept. Jalapa: *Steyermark 32533.*

Distribution: Mexico, Costa Rica.

On trees at low to medium altitudes. I doubt if any distinction can be made between this species and *P. pulchella* Schimp., which seems to be only a slenderer, softer form. When this group is

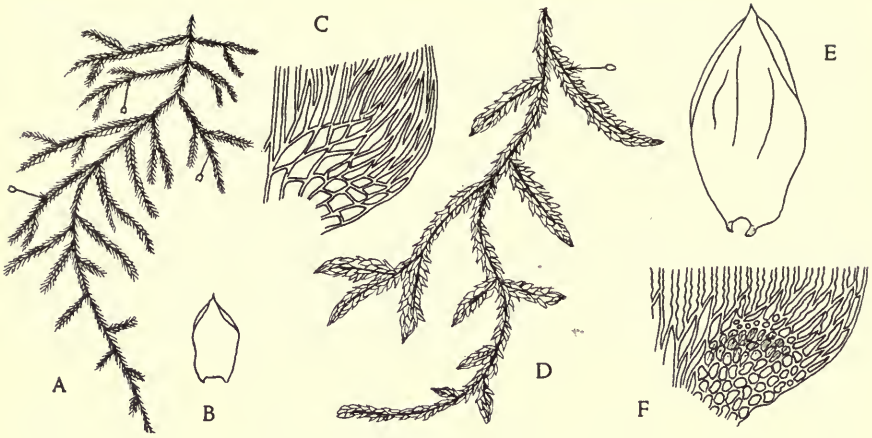

FIGURE 118

A–C, *Pilotrichella rigida:* A, part of plant, ×1; B, leaf, ×12; C, basal angle of leaf, ×270.

D–F, *Pilotrichella flexilis:* D, part of plant, ×1; E, leaf, ×12; F, basal angle of leaf, ×120.

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studied critically it is likely that *P. rigida* or its equivalent will acquire an extensive synonymy with a corresponding broadening of its geographical distribution.

2. PILOTRICHELLA FLEXILIS (Hedw.) Jaeg., Adumb. **2**: 162. 1875–76.

Leskea flexilis Hedw., Sp. Musc. 234. 1801.

Robust plants pale green at tips, brown and often richly colored below; secondary stems to 25 or 30 cm. long, distantly pinnate, branches tumid. Leaves laxly imbricated, about 2.5 mm. long, 1 mm. wide, oblong-ovate from a narrow, auriculate base, abruptly short apiculate; margins entire, broadly inflexed above; cells narrowly linear with sinuose lateral walls, small, rounded, and deep brown in a small but well defined group at basal angles. Seta 5 mm. long, scabrous above; capsule ovoid, 1.5 mm. long; peristome teeth incurved when dry, segments of endostome capillary, shorter than teeth. (Fig. 118, D–F.)

Dept. Alta Verapaz: *Standley 70350, 71149, 71154, 71592, 90245a, 90633, 90665, 90725, 92361, 92407.* Dept. Huehuetenango: *Steyermark 48473, 49902a.* Dept. San Marcos: *Steyermark 36030.* Dept. Totonicapan: *Standley 62651.* Dept. Sacatepequez: *Standley 65103.* Dept. Solola: *Steyermark 47236.* Dept. Chimaltenango: *Standley 57826a, 58729, 58793a, 58802b, 61929b.* Dept. Guatemala: *Standley 58434, 58459, 80629* (c. fr.), *80694.* Dept. El Progresso: *Steyer-*

mark 43550. Dept. Zacapa: *Steyermark 43227.* Dept. Chiquimula: *Steyermark 30601.* Dept. Jalapa: *Steyermark 32487.*

Distribution: Mexico, West Indies, Central and South America.

Pendent from forest trees at moderate altitudes. This frequent and well-known species has an extensive synonymy including *Neckera turgescens* C. M. and *N. cochlearifolia* C. M. of Mexico.

3. PAPILLARIA C. M., Oefv. K. Sv. Vet.-Akad. Forh. **4**: 34. 1876.

Slender, dull green plants tinged with brown or black; secondary stems numerous, often pendent in intricate masses. Leaves imbricated, acuminate, auriculate; costa single; cells incrassate, papillose; Capsules mostly exserted; seta smooth; peristome double; calyptra in our species cucullate, pilose.

1. Leaves with large, undulate basal auricles.....1. *P. imponderosa*
   Leaf base not strongly auriculate.....2
2. Plants soft, leaves ending in a long, capillary hair point.....3. *P. Deppei*
   Plants rigid, leaves subulate-acuminate, not hair tipped.....2. *P. nigrescens*

1. PAPILLARIA IMPONDEROSA (Tayl.) Broth., E. & P. Pflanzenf. **1**[3]: 815. 1906.

Leskea imponderosa Tayl., Lond. Journ. Bot. **1846**: 62. 1846.
Neckera Oerstediana C. M., Syn. **2**: 671. 1851.

Very slender, dull yellowish green plants; secondary stems to 12–15 cm. long, flexuous, laxly pinnate. Leaves erect-spreading, 1.5–1.8 mm. long, lanceolate from a cordate, faintly plicate, strongly auriculate base, acuminate, apex twisted in a half turn; margins plane, sharply denticulate all around; costa slender, ending above mid-leaf; cells linear, seriate papillose, more pellucid at extreme base. Capsule exserted on a short seta. (Fig. 119, A–B.)

Dept. Alta Verapaz: *Standley 70490, 70945, 70953, 71194, 90621, 90705, 91474.* Dept. Huehuetenango: *Steyermark 52009; Standley 68474, 86535.*

Distribution: Mexico, Central and South America.

On trees at medium to high altitudes. The relatively large, often undulate basal auricles and the flat, linear acumen twisted in a half turn make this species easy of recognition.

2. PAPILLARIA NIGRESCENS (Hedw.) Jaeg., Adumb. **2**: 169. 1875–76.

Hypnum nigrescens Hedw., Sp. Musc. 250. 1801.

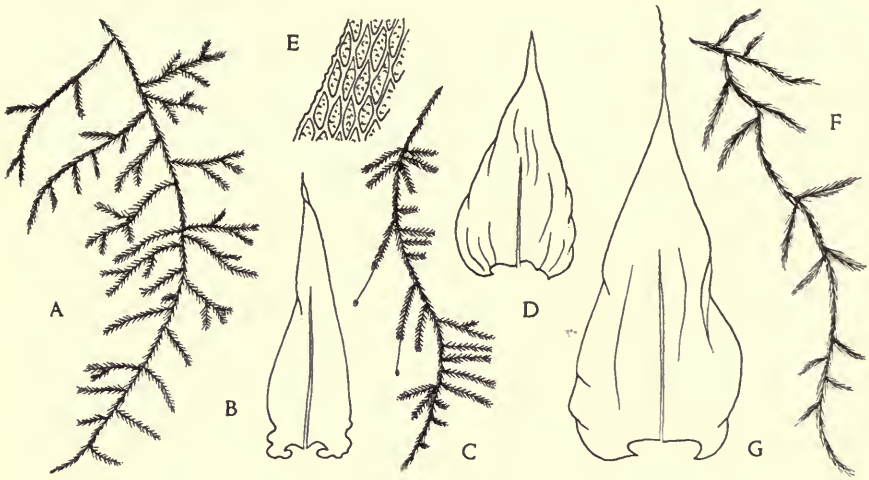

FIGURE 119

A–B, *Papillaria imponderosa:* A, part of plant, ×1; B, leaf, ×24.
C–E, *Papillaria nigrescens:* C, part of plant, ×1; D, leaf, ×24; E, upper leaf cells and margin, ×270.
F–G, *Papillaria Deppei:* F, part of plant, ×1; G, leaf, ×24.

Plants green or yellowish green at tips, brown or black below; secondary stems prostrate in intricate mats, to 12–15 cm. long, irregularly pinnate. Leaves appressed when dry, erect-spreading when moist, to 1.7 mm. long, ovate from a cordate base, slenderly acuminate, faintly plicate; margins often undulate, serrulate toward base, entire above; costa slender, ending above mid-leaf; cells linear or oval, papillose except near costa at extreme base. Seta short; capsule exserted. (Fig. 119, C–E.)

Dept. Peten: *Steyermark 46096.* Dept. Izabal: *Steyermark 39486, 39497, 39757a, 39998; Standley 72134, 72518, 72522a, 72573.* Dept. Alta Verapaz: *Steyermark 44116, 44859; Standley 69270, 69556, 70829, 70972, 71021b, 71788, 71839, 90040, 90773c, 90874.* Dept. Huehuetenango: *Steyermark 49654.* Dept. San Marcos: *Standley 86463, 86467.* Dept. Retalhuleu: *Standley 87886.* Dept. Baja Verapaz: *Standley 69745, 69786, 91154.* Dept. Jutiapa: *Standley 75553.* Dept. Santa Rosa: *Standley 78188.*

Distribution: Florida, Louisiana, Mexico, West Indies, Central and South America.

On tree trunks at low to medium altitudes. The variations of this plastic species are legion and I doubt if any practical purpose would be served in trying to segregate them here. The form with shorter leaf cells and slender microphyllous branchlets known as

P. appressa (Hornsch.) is usually but not always recognizable. The leaves of *P. nigrescens* are often broadly auriculate but never so strongly so as in *P. imponderosa*.

3. PAPILLARIA DEPPEI (Hornsch.) Jaeg., Adumb. **2**: 168. 1874–75.

Neckera Deppei Hornsch. in C. M., Syn. **2**: 136. 1851.

Papillaria Hahnii Besch., Bull. Soc. Roy. Bot. Belg. **38**: 228. 1899.

Slender, soft plants, pale green at tips, brown or black below; secondary stems prostrate or pendent, to 20 or 30 cm. long, laxly pinnate. Leaves appressed when dry, 2–2.5 mm. long, triangular-lanceolate from a cordate base, gradually acuminate, faintly plicate, apex prolonged in a fine, articulated, capillary hair point; margins often undulate, minutely denticulate; costa faint, ending above mid-leaf; cells linear, papillose on both faces with 3–4 sharp, salient papillae. Seta about 6 mm. long; capsule ovoid, erect. (Fig. 119, F–G.)

Dept. Alta Verapaz: *Standley 69441, 69995b, 70008, 71104, 90719, 90870, 91366*. Dept. Sacatepequez: *Standley 58873a*. Dept. Chimaltenango: *Standley 62321, 80229, 80302*. Dept. Guatemala: *Standley 80735*. Dept. Zacapa: *Steyermark 29832*.

Distribution: Mexico, West Indies, Central and South America.

On forest trees at medium altitudes. This species is likely to be confused with *Meteorium illecebrum* from which it may be distinguished by the more slender, softer habit and the less strongly plicate, gradually attenuate leaves with the cells showing several papillae on each face.

EXCLUDED SPECIES

PAPILLARIA WARSZEWICZII C. M., Bull. Herb. Boiss. **5**: 205. 1897.

No material is available for comparison.

4. METEORIUM Doz. & Molk., Musc. Archip. Ind. ined. 157. 1854.

Robust, glossy plants; secondary stems long, pendent, distantly pinnate, branches densely foliate, tumid. Leaves oblong-ovate, plicate, abruptly piliform acuminate; costa slender; cells long and narrow, unipapillate. Seta short; capsules exserted; peristome double; calyptra cucullate, pilose.

1. METEORIUM ILLECEBRUM (C. M.) Mitt., Journ. Linn. Soc. **12**: 437. 1869.

Neckera illecebra C. M., Syn. **2**: 137. 1851.

Plants robust, pale or yellowish green at tips, brown or black below; secondary stems creeping or pendent, 5–30 cm. long or longer, distantly pinnate, branches short and blunt at tips. Leaves laxly appressed when dry, 3–4 mm. long, oblong-ovate from a cordate base, concave, plicate, abruptly contracted to a slender acumen which is prolonged in a fragile, capillary, articulated hair point; margins denticulate, flexuous; costa ending above mid-leaf; cells linear, with a single central papilla over the lumen. Seta 6–7 mm. long, smooth below, scabrous above; capsule ovoid, contracted to a short neck, urn 1.5 mm. long; lid obliquely beaked, 1.5 mm. long; peristome teeth pale, papillose, segments of endostome filiform. (Fig. 120, A–C.)

Dept. Alta Verapaz: *Standley 70010, 70385a, 89713, 90599, 92361b, 92664; Steyermark 44571a.* Dept. Huehuetenango: *Standley 82556, 83037; Steyermark 48485a, 49607, 50077a, 50599.* Dept. San Marcos: *Steyermark 35681, 35815a, 35846, 36929; Standley 85428.* Dept. Totonicapan: *Standley 84038, 84102a.* Dept. Quezaltenango: *Standley 66389, 84186a.* Dept. Chimaltenango: *Standley 57938, 60012.* Dept. Guatemala: *Standley 58412b.* Dept. Baja Verapaz: *Standley 69763, 69786a, 91092, 91096, 91199.* Dept. El Progresso: *Steyermark 43485a.* Dept. Zacapa: *Steyermark 42788, 43149.* Dept. Jalapa: *Steyermark 32839a; Standley 77500.*

Distribution: Mexico, Central America, West Indies.

On trees or occasionally on rocks and banks at medium to rather high altitudes. Nos. 57938 and 60012 represent a form with capillary branchlets on which the minute leaves are sinuate-denticulate and the cells strongly papillose, which may be the same thing as *M. sinuatum* (C. M.) Mitt. No. 89713 shows the branches tumid and obtuse and the leaves with shorter points similar to var. *teretiforme* Card. (Rev. Bryol. **38**: 40. 1911) but as in *Papillaria nigrescens* these forms lack stability and are probably nothing but variants influenced by environmental conditions.

5. LINDIGIA Hampe, Linnaea **31**: 427. 1861–62.

Autoicous; slender plants; secondary stems numerous, pinnately branched, foliate on all sides. Leaves spreading, ovate-lanceolate; costa single, slender; cells linear, smooth. Seta short, scabrous; capsules exserted; lid beaked; peristome double; calyptra cucullate.

1. LINDIGIA ACICULATA (Tayl.) Jaeg., Adumb. **2**: 378. 1876–77.

Leskea aciculata Tayl., Lond. Journ. Bot. 6: 339. 1847.

Lindigia tenella Hampe, in Besch. Prodr. Bryol. Mex. 104. 1871.

Secondary stems to 4 or 5 cm. long. Stem leaves 2.5 mm. long, ovate-lanceolate from a broad, slightly cordate base, subulate-acuminate, serrulate all around; costa ending above mid-leaf; cells linear, smooth, shorter across insertion, not differentiated at basal angles. Branch leaves similar but smaller. Perichaetial leaves erect, ending in a long, denticulate arista; seta 2 mm. long, scabrous, slightly curved; capsule oblong, suberect, urn 1 mm. long, mouth deep red; peristome teeth strongly incurved, segments as long as teeth; lid long and slenderly beaked. (Fig. 120, D–F.)

Dept. Alta Verapaz: *Standley 90368*. Dept. Chimaltenango: *Standley 62030c* (as *Rhynchostegiella convolutacea*).

Distribution: Mexico, Jamaica, South America.

On trees at medium altitudes. I can detect no real differences between *L. tenella* and *L. aciculata* and believe that Hampe's name can safely be relegated to synonymy.

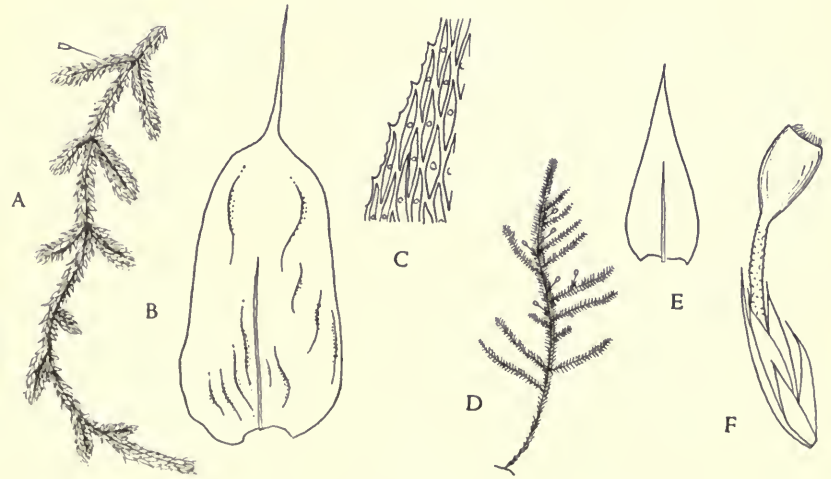

FIGURE 120

A–C, *Meteorium illecebrum:* A, part of plant, ×1; B, leaf, ×16; C, upper leaf cells and margin, ×270.

D–F, *Lindigia aciculata:* D, plant, ×1; E, leaf, ×14; F, sporophyte, ×10.

6. BARBELLA (C. M.) Fleisch., E. & P. Pflanzenf. 1³: 828. 1906.
Pilotrichella Sec. *Barbella* C. M., Flora **82**: 464. 1896.

Slender, glossy plants usually pendent in loose masses; secondary stems pinnate, ultimate branches often filiform. Leaves lanceolate; costa single or lacking; cells linear, smooth or faintly papillose. Seta short; capsules exserted; peristome double; calyptra small, fugacious.

1. BARBELLA CUBENSIS (Mitt.) Broth., E. & P. Pflanzenf. 1³: 824. 1906.

Meteorium cubense Mitt., Journ. Linn. Soc. **12**: 435. 1869.
Meteorium diclados Schimp. in Besch., Prodr. Bryol. Mex. 83. 1871.

Plants glossy, pale yellow at tips, brown below; secondary stems pendent, to 25–30 cm. long, pinnately branched, ultimate branches slender and attenuate. Leaves of lower stems and branches laxly spreading, complanate, 3–3.5 mm. long, ovate-lanceolate from a subcordate base, subulate-acuminate, ecostate; margins entire above, serrulate toward base; cells linear, usually with a faint papilla over middle of lumen, irregularly short rhomboidal and incrassate in a small, poorly defined group at basal angles. Leaves of ultimate branches appressed, narrower and with long, capillary points. Sporophyte not seen. (Fig. 121, A–D.)

Dept. Alta Verapaz: *Standley 71668*. Dept. Zacapa: *Steyermark 42797*.

Distribution: Mexico, Cuba.

On trees at moderately high altitudes. *Meteorium cubense* Mitt. is given by Brotherus (E. & P. Pflanzenf. ed. 1) as a synonym for both *Barbella cubensis* (Mitt.) Broth. and *Squamidium cubense* (Mitt.) Broth. Wright's No. 82 is evidently a *Barbella*, so the name *Squamidium cubense* should be suppressed.

7. METEORIOPSIS Fleisch., E. & P. Pflanzenf. 1³: 825. 1906.

Rather slender, glossy plants, often pendulous; secondary stems elongate, irregularly pinnate. Leaves widely spreading, ovate-lanceolate, serrulate; costa slender; cells narrow, smooth, not sharply differentiated at basal angles. Seta short; capsules exserted; peristome double; calyptra small, mitriform, pilose.

1. Leaves spreading from the insertion ..... 1. *M. remotifolia*
Leaves spreading from a clasping base 2
2. Slender plants, leaves decurved, short pointed ..... 2. *M. recurvifolia*
Plants more robust, leaves long acuminate ..... 3. *M. patula*

1. METEORIOPSIS REMOTIFOLIA (Hornsch.) Broth., E. & P. Pflanzenf. 1[3]: 825. 1906.

Neckera remotifolia Hornsch. in C. M., Syn. 2: 672. 1851.

?Meteorium torticuspis C. M., Bull. Herb. Boiss. 5: 204. 1897.

Slender plants growing in feathery mats; secondary stems prostrate, elongate, freely branched. Leaves squarrose-spreading from insertion, about 1.3 mm. long, broadly ovate from a narrow, subcordate base, subulate-acuminate; margins narrowly recurved near base, plane and serrulate above; costa ending well above mid-leaf; cells linear, smooth, subquadrate in a small, poorly defined area at basal angles. Seta 1 mm. long; capsules oblong, short exserted; lid obliquely beaked; calyptra scabrous above. (Fig. 121, E–G.)

Dept. Alta Verapaz: *Standley 89870, 91675, 91740, 91758, 91810; Steyermark 44816, 45008.* Dept. San Marcos: *Standley 86548a.* Dept. Sacatepequez: *Standley 88961b.* Dept. Solola: *Steyermark 47951, 47992.*

Distribution: Mexico, Jamaica, Central and South America.

On trees and humus at moderate altitudes. I have not seen the type of *M. torticuspis* C. M. but the description strongly suggests that it belongs here.

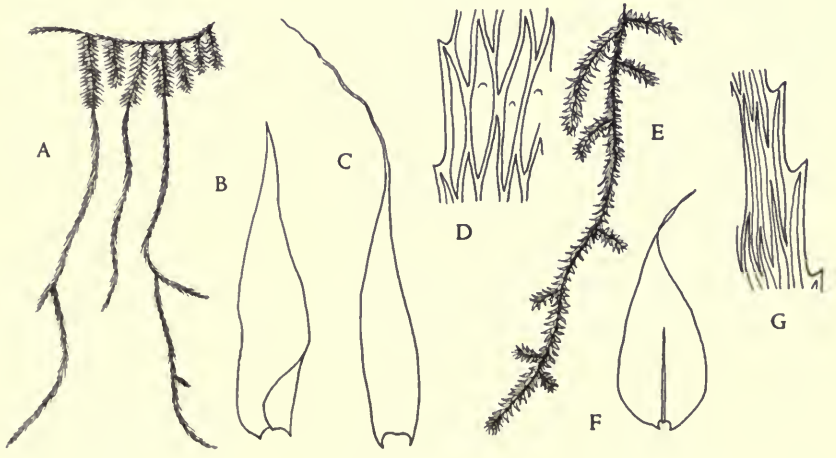

FIGURE 121

A–D, *Barbella cubensis:* A, part of plant, ×1; B, lower branch leaf, ×16; C, ultimate branch leaf, ×16; D, upper leaf cells and margin, ×270.

E–G, *Meteoriopsis remotifolia:* E, part of plant, ×1; F, leaf, ×20; G, upper leaf cells and margin, ×270.

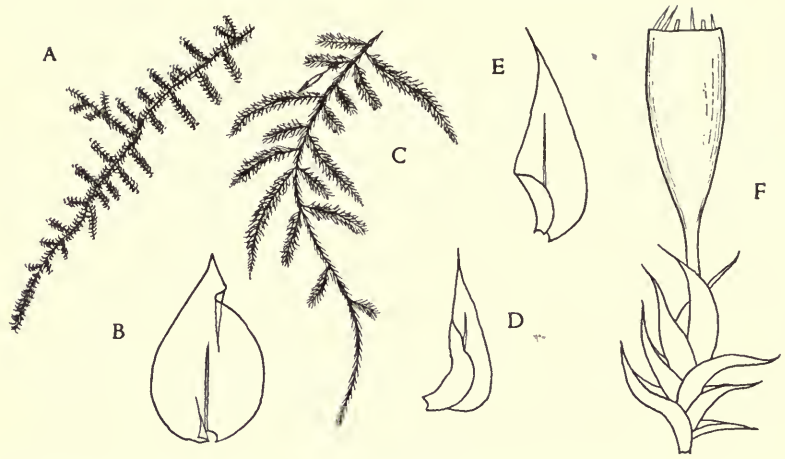

FIGURE 122

A–B, *Meteoriopsis recurvifolia:* A, part of plant, ×1; B, leaf, ×14.

C–F, *Meteoriopsis patula:* C, part of plant, ×1; D and E, leaves, ×14; F, sporophyte, ×8.

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2. METEORIOPSIS RECURVIFOLIA (Hornsch.) Broth., E. & P. Pflanzenf. 1[3]: 825. 1906.

Pilotrichum recurvifolium Hornsch., Fl. Bras. 1: 58. 1840.

Secondary stems elongate, pinnate, branches short. Leaves crowded, 1.5–1.8 mm. long, squarrose-recurved from a narrow, cordate, clasping base, broadly ovate, carinate-concave, short acumnate, serrulate all around; costa ending above mid-leaf; cells linear, alar group scarcely differentiated. Seta 2 mm. long; capsule oblong, urn 1.5 mm. long, tapering to a short neck; lid slenderly beaked, erect; calyptra pilose. (Fig. 122, A–B.)

Dept. Peten: *Lundell 2733.*

Distribution: Costa Rica, Panama, South America.

On trees at low altitudes. The shorter pointed, decurved leaves will easily separate this species from *M. patula.*

3. METEORIOPSIS PATULA (Hedw.) Broth., E. & P. Pflanzenf. 1[3]: 825. 1906.

Hypnum patulum Hedw., Sp. Musc. 279. 1801.

Plants pale green, growing in soft, tangled mats; secondary stems prostrate or pendent, elongate, pinnate, branches short. Leaves

2–2.5 mm. long, ovate-lanceolate from a contracted clasping base, narrowed to a rather long, slender acumen, serrulate nearly to base; costa ending well above mid-leaf; cells narrowly linear, shorter across insertion, subrectangular in a small, poorly defined group at basal angles. Seta 3 mm. long; capsule oblong, urn 2.5 mm. long; lid slenderly beaked; calyptra pilose. (Fig. 122, C–F.)

Dept. Peten: *Steyermark 46046; Lundell 2040.* Dept. Izabal: *Standley 72522.* Dept. Alta Verapaz: *Standley 69976, 69990, 69995, 70200, 70544, 70735, 71246a, 71328, 71413, 71668a, 90315a, 91366b, 91586; Steyermark 44857.* Dept. San Marcos: *Steyermark 37500a; Standley 68556.* Dept. Quezaltenango: *Standley 67073, 68015, 85011, 85511a, 85547, 86688a.* Dept. Chimaltenango: *Standley 62030.* Dept. Guatemala: *Standley 58412a.*

Distribution: Florida, Mexico, West Indies, Central and South America.

On trees at low to medium altitudes. Variable in habit and leaf outline but usually easily recognized by the leaves strongly clasping below and ending in a fine, almost capillary, hair-like point.

32. PHYLLOGONIACEAE

Lustrous plants with sparingly branched, strongly flattened secondary stems. Leaves rigid, equitant, distichous, cymbiform-concave, abruptly short pointed; costa short and double or lacking; cells linear, smooth. Sporophyte lateral; capsules exserted in our species; calyptra cucullate.

Alar cells dark brown, incrassate, conspicuous.....1. *Phyllogonium*
Alar cells not differentiated.....2. *Eucatagonium*

1. PHYLLOGONIUM Brid., Bryol. Univ. **2**: 671. 1827.

Slender, golden green, glossy plants; secondary stems pendent, flat, irregularly pinnate. Leaves erect-spreading, ecostate, oblong, short apiculate; cells linear, short, incrassate and deep brown at basal angles. Capsule ovoid, exserted on a short seta; peristome double; calyptra sparingly pilose.

1. PHYLLOGONIUM FULGENS (Hedw.) Brid., Bryol. Univ. **2**: 671. 1827.

Pterigynandrum fulgens Hedw., Sp. Musc. 86. 1801.

Secondary stems to 50 cm. or more long, distantly pinnate, branches 3–4 mm. wide with leaves. Leaves closely distichous, 2.5–3

mm. long, deeply cymbiform-concave, entire, apiculus often recurved; cells narrowly linear, smooth, alar group dark brown, incrassate, not sharply differentiated. Seta 3 mm. long; capsule ovoid; lid slenderly beaked. (Fig. 123, A–B.)

Dept. Izabal: *Steyermark 41935.* Dept. Alta Verapaz: *Standley 71592a, 71697, 89867, 90729, 91599.* Dept. Huehuetenango: *Steyermark 48807.* Dept. Zacapa: *Steyermark 42806.*

Distribution: Mexico, West Indies, Central and South America.

On forest trees at moderate altitudes. An attractive moss readily recognized by the crowded, keeled, glossy leaves in 2 lateral rows.

2. EUCATAGONIUM (Broth.) Fleisch., Laubmfl. Java **4**: 28. 1922.

Catagonium Sec. 1, *Eucatagonium* Broth., E. & P. Pflanzenf. **1**[3]: 1088. 1908.

Slender, pale green glossy plants growing in thin mats; stems prostrate, irregularly branched. Leaves spreading, distichous, concave, abruptly apiculate, entire; costa short and double; cells linear, not differentiated at basal angles. Seta elongate, smooth; capsules inclined; peristome double; calyptra naked.

1. EUCATAGONIUM POLITUM (H. f. & W.) Broth., E. & P. Pflanzenf. ed. 2, **11**: 178. 1925.

Hypnum politum H. f. & W., Lond. Journ. Bot. **3**: 353. 1844.

Stems to 3 or 4 cm. long, about 1.5 mm. wide with leaves. Leaves about 1 mm. long, oblong, deeply concave, abruptly contracted to a slender, recurved apiculus; costa short, faint and double; cells narrowly linear, smooth, not differentiated at basal angles. No fruiting plants known from North America. (Fig. 123, C–E.)

Dept. Chiquimula: *Steyermark 31017.*

Distribution: Costa Rica, South America, Australia, Tasmania, New Zealand.

Terrestrial in cloud forest. This collection shows the leaves very abruptly constricted at the apex and often even slightly emarginate and asymmetrical. The Costa Rican plants are very similar, and although both differ rather widely from the South American and New Zealand forms I suspect that they are all variants of one specific type.

33. NECKERACEAE

Plants often robust, glossy. Primary stems creeping; secondary stems erect or pendent, subpinnate, strongly flattened. Leaves complanate, often undulate, short pointed; costa single or double and short; cells smooth, rhomboidal above, linear toward base. Sporophyte lateral on branches of secondary stems; capsules immersed or exserted; peristome double, endostome with narrow segments from a well developed basal membrane.

1. Leaf base strongly cordate or auriculate.....1. *Calyptothecium*
   Leaf base not cordate or auriculate.....2
2. Costa none or very short and double.....3
   Costa single, well developed.....4
3. Leaves in 8 rows, capsules immersed or short exserted.....2. *Neckera*
   Leaves in 4 rows, setae elongate.....5. *Homalia*
4. Plants glossy, costa slender, ending near mid-leaf.....5
   Plants dull, costa stout, ending near apex.....6
5. Leaf apex truncate or broadly rounded, denticulate.....3. *Neckeropsis*
   Leaf apex pointed, coarsely incised-serrate.....4. *Homaliodendron*
6. Leaves rounded, denticulate.....6. *Pinnatella*
   Leaves pointed, coarsely toothed.....7. *Porotrichum*

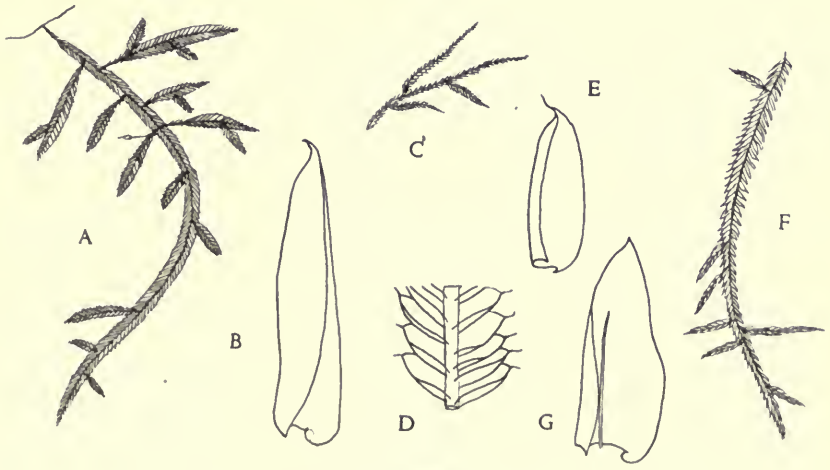

FIGURE 123

A–B, *Phyllogonium fulgens:* A, part of plant, ×1; B, leaf, ×14.
C–E, *Eucatagonium politum:* C, plant, ×1; D, part of stem, ×10; E, leaf, ×22.
F–G, *Calyptothecium duplicatum:* F, part of plant, ×1; G, leaf, ×10.

1. CALYPTOTHECIUM Mitt., Journ. Linn. Soc. **10**: 190. 1868.

Dioicous; robust, glossy plants; secondary stems numerous, often pendent, pinnate, usually flattened. Leaves crowded, frequently undulate and auriculate, short pointed; costa single, slender; cells linear, smooth. Capsules immersed; peristome double, segments of endostome from a low basal membrane; lid conic-rostrate; calyptra small.

Leafy stems strongly flattened.....1. *C. duplicatum*
Stems tumid, not flattened.....2. *C. turgescens*

1. CALYPTOTHECIUM DUPLICATUM (Schwaegr.) Broth., E. & P. Pflanzenf. 1^3: 839. 1906.

Hypnum duplicatum Schwaegr., Suppl. 1^2: 198. 1816.

Plants yellowish green; secondary stems 8–10 cm. long or longer, distantly pinnate, strongly flattened, to 3–4 mm. wide with leaves, branches often flagelliform-attenuate. Leaves crowded, very complanate, 2.5–3 mm. long, oblong-ovate from a subcordate base, short acuminate, concave, entire, slightly undulate; costa slender, ending above mid-leaf; cells linear, shorter and colored across insertion. Capsule ovoid, immersed. (Fig. 123, F–G.)

Dept. Chiquimula: *Steyermark 31710.*

Distribution: West Indies, South America.

On trees in cloud forest at moderate altitude. This is the first record for the species in Central America as far as I know. It is a conspicuous, attractive moss and evidently rare on the mainland in North America.

2. CALYPTOTHECIUM TURGESCENS Broth. & Thér., Soc. Havr. d'Etud. Div. **88**: 312. 1921.

Secondary stems erect, 6–8 cm. high, yellowish green, irregularly branched, branches tumid, obtuse, densely foliate. Leaves laxly imbricated, 3–4 mm. long, oblong-ovate from a cordate base, short acuminate, entire, concave, undulate; costa slender, ending above mid-leaf; cells linear, shorter and colored across insertion. Cylindrical, septate propagula are frequent in axils of the branch leaves. Fruit unknown. (Fig. 124, A–B.)

Dept. Alta Verapaz: *Standley 71822.*

Distribution: Costa Rica.

On trees at moderate altitude. Very distinct from *C. duplicatum* in the tumid stems and branches with the leaves spreading on all sides.

2. NECKERA Hedw., Sp. Musc. 200. 1801.

Secondary stems pendent or prostrate, irregularly pinnate, flattened. Leaves crowded, complanate, oblong, undulate, short pointed, asymmetrical; costa double and short in our species; cells linear, smooth, shorter toward apex. Capsules immersed or exserted; peristome double; lid conic-rostrate.

1. Capsules plainly exserted ..... 3. *N. urnigera*
   Capsules immersed 2
2. Inner perichaetial leaves filiform-acuminate, segments of endostome shorter than teeth ..... 2. *N. Ehrenbergii*
   Inner perichaetial leaves shorter acuminate, segments as long as teeth ..... 1. *N. chlorocaulis*

1. NECKERA CHLOROCAULIS C. M., Syn. **2**: 663. 1851.

Autoicous; secondary stems prostrate, yellowish green, irregularly pinnate, to 15 cm. long, branches often attenuate. Leaves 3–4 mm. long, oblong-ovate, short acuminate, strongly undulate, broadly

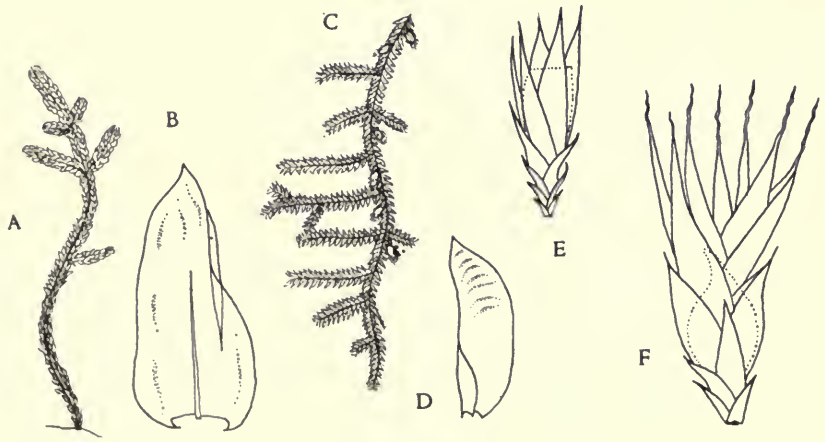

FIGURE 124

A–B, *Calyptothecium turgescens:* A, plant, ×1; B, leaf, ×10.
C–E, *Neckera chlorocaulis:* C, part of plant, ×1; D, leaf, ×8; E, sporophyte, ×6.
F, *Neckera Ehrenbergii:* F, sporophyte, ×6.

inflexed on one side below; margins recurved at extreme base, plane above, serrulate toward apex; costa very short, double; cells linear, rhomboidal toward apex. Inner perichaetial leaves 4.5–5 mm. long, ovate, gradually narrowed to flat, denticulate acumen; seta 1.5 mm. long; capsule ovoid, urn 2 mm. long; segments of endostome slender, from a low basal membrane, about as long as teeth; lid obliquely rostrate. (Fig. 124, C–E.)

Dept. Huehuetenango: *Standley 81742, 81764.* Dept. San Marcos: *Steyermark 35563, 35564a, 35664a, 35845; Standley 66154, 85419.* Dept. Totonicapan: *Standley 65903, 65928, 65937.* Dept. Quezaltenango: *Steyermark 33941a; Standley 84256.* Dept. Sacatepequez: *Standley 63711c, 65246.* Dept. Chimaltenango: *Standley 79834.*

Distribution: Mexico, Costa Rica.

On trees, banks and rocks, mostly at rather high altitudes. Probably more broadly distributed in Central America than the published records would indicate.

2. NECKERA EHRENBERGII C. M., Syn. **2**: 51. 1851.

Plants similar to and scarcely to be distinguished from *N. chlorocaulis*. Inner perichaetial leaves 6–7 mm. long, ovate-lanceolate, gradually narrowed to a long, fine, denticulate point; capsule ovoid, immersed; segments of endostome shorter than teeth. (Fig. 124, F.)

Dept. San Marcos: *Standley 85397* (as *N. chlorocaulis*). Dept. Totonicapan: *Standley 62690* (as *N. chlorocaulis*), *84422* (as *N. chlorocaulis*), *84525* (as *N. chlorocaulis*). Dept. Quezaltenango: *Standley 67666* (as *N. chlorocaulis*), *84253* (as *N. chlorocaulis*). Dept. Sacatepequez: *Standley 65090* (as *N. chlorocaulis*), *65198* (as *N. chlorocaulis*). Dept. Solola: *Steyermark 47235, 47240, 47568a.* Dept. Chimaltenango: *Standley 61921* (as *N. chlorocaulis*), *61929a* (as *N. chlorocaulis*).

Distribution: Mexico.

On trees in damp forests mostly at high altitudes. The distinctions between this species and *N. chlorocaulis* are slight and not always satisfactory. After restudying the group I have referred here the plants with long and slenderly acuminate perichaetial leaves. The endostome seems to vary, often showing the segments clearly shorter than the teeth but occasionally longer and very similar in structure to that of *N. chlorocaulis.*

3. NECKERA URNIGERA C. M., Syn. **2**: 57. 1851.

Secondary stems to 4 or 5 cm. long, pinnate, branches widely spreading, about 2 cm. long. Leaves 2–2.5 mm. long, oblong-ovate,

short acuminate, undulate, denticulate toward apex; costa short, double; cells linear. Perichaetium small, inner leaves 2 mm. long, convolute, acuminate; seta 2.5–3 mm. long; capsule oblong, exserted, urn wide mouthed, 1.5–2 mm. long; peristome teeth narrow, minutely papillose, segments of endostome slender, almost as long as teeth. (Fig. 125, A–C.)

Dept. Alta Verapaz: *Standley 70010b*. Dept. Quezaltenango: *Standley 85511*. Dept. Sacatepequez: *Standley 63711*. Dept. Chimaltenango: *Standley 62030a*.

Distribution: Mexico.

On trees at moderate altitudes. Readily distinguished from both of the preceding species by the exserted capsules but closely allied to a number of similar species ranging from Mexico to South America which need to be carefully resolved.

3. NECKEROPSIS Reichd't., Novara Exp. Bot. **1**: 181. 1870 emend. Fleisch., Laubmfl. Java **3**: 875. 1907.

Glossy plants with long, sparingly branched, very flat secondary stems. Leaves horizontally spreading, often undulate, broadly rounded or truncate at apex; costa single in our species; cells smooth, rhomboidal toward apex, linear below. Perichaetium conspicuous; capsules immersed; peristome double, lid conic-rostrate; calyptra small, often pilose.

1. Inner perichaetial leaves lanceolate, gradually acuminate.....3. *N. foveolata*
   Inner perichaetial leaves linear-subulate.....2
2. Leaves undulate, autoicous.....1. *N. undulata*
   Leaves not undulate, synoicous.....2. *N. disticha*

1. NECKEROPSIS UNDULATA (Hedw.) Reichd't., Novara Exp. Bot. **1**: 181. 1870.

Neckera undulata Hedw., Sp. Musc. 201. 1801.

Autoicous; plants pale or yellowish green; secondary stems to 5 cm. long, complanate, sparingly branched, 4 mm. wide with leaves very closely spaced, horizontally spreading, 2–2.5 mm. long, oblong-lingulate from an asymmetrical, clasping base, broadly truncate at apex, transversely undulate; margins plane, erose-denticulate across apex; costa slender, often forked at tip, ending some distance below apex; upper cells irregularly rhomboidal, gradually becoming linear below. Perichaetial leaves linear-subulate, extending well above rim of capsule; seta very short; capsule oblong-

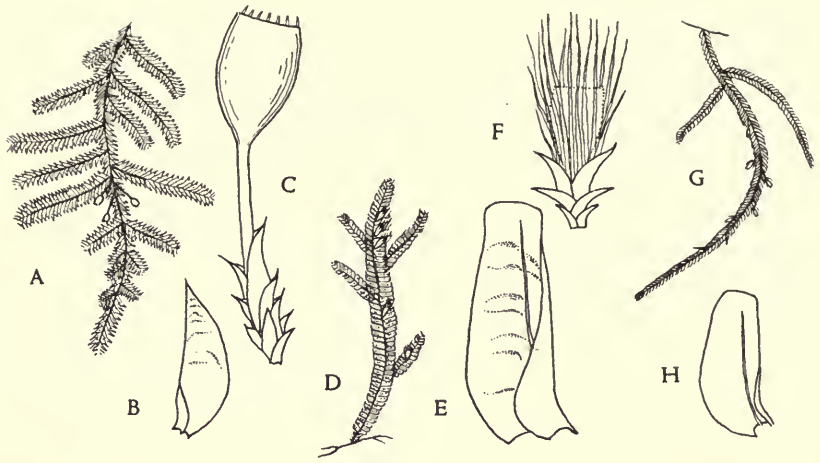

FIGURE 125

A–C, *Neckera urnigera:* A, plant, ×1; B, leaf, ×8; C, sporophyte, ×8.
D–F, *Neckeropsis undulata:* D, plant, ×1; E, leaf, ×14; F, sporophyte, ×8.
G–H, *Neckeropsis disticha:* G, plant, ×1; H, leaf, ×14.

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cylindric, urn 1.5 mm. long; lid obliquely rostrate; peristome teeth narrow, segments of endostome filiform, equaling the teeth; calyptra sparingly pilose. (Fig. 125, D–F.)

Dept. Peten: *Steyermark 46191.* Dept. Izabal: *Steyermark 38905a, 41813.* Dept. Alta Verapaz: *Standley 91749.*

Distribution: Florida, Texas, Mexico, West Indies, Central and South America.

On trees at low altitudes. A lowland species widely distributed in tropical America and easily known by the truncate, undulate leaves.

2. NECKEROPSIS DISTICHA (Hedw.) Fleisch., Laubmfl. Java **3**: 879. 1907.

Neckera disticha Hedw., Sp. Musc. 201. 1801.

Synoicous; more slender than *N. undulata.* Leaves smaller, seldom more than 1.5 mm. long, not transversely undulate and less widely spreading. Perichaetial leaves shorter, barely reaching rim of capsule; calyptra naked. (Fig. 125, G–H.)

Dept. Peten: *Steyermark 45913, 45914.* Dept. Izabal: *Steyermark 39758, 39928; Standley 72417a.* Dept. Alta Verapaz: *Steyermark 44306, 45039, 45124.*

Distribution: Florida, wide in Mexico, West Indies, Central and South America.

On trees at low altitudes. Like *N. undulata* this species seems to be confined to the Caribbean lowlands and fails to appear in the Pacific drainage area.

3. NECKEROPSIS FOVEOLATA (Mitt.) Broth., E. & P. Pflanzenf. Ed. 2, **11**: 188. 1925.

Neckera foveolata Mitt., Trans. Linn. Soc. **23**: t. 5, f. 5. 1862.

Autoicous; secondary stems 2–4 cm. long, sparingly pinnate, 4–5 mm. wide with leaves. Leaves horizontally spreading, undulate, structurally in all respects like *N. undulata*. Perichaetial leaves clasping, ovate-lanceolate, acuminate, entire; seta less than 0.5 mm. long; capsule oblong-cylindrical, immersed, urn 1.5 mm. long; peristome teeth nearly or quite smooth, pellucid, segments as long as teeth; lid erect, slenderly beaked; spores papillose, 15 μ. (Fig. 126, A–B.)

Dept. Izabal: *Steyermark 41879a.*

Distribution: Costa Rica, Brazil, western Africa.

On leaves at moderately low altitude. The gametophyte is inseparable from *N. undulata* but the broad, clasping perichaetial leaves are very distinctive. The distribution is interesting and may be adduced as a factor favoring the Continental Drift theory. The Guatemalan specimen is fragmentary but the plants from Costa Rica collected by A. M. Brenes (*N. Brenesei* Bartr. in herb.) are in fine condition and show the distinctive characters to good advantage.

4. HOMALIODENDRON Fleisch., Hedwigia **45**: 72. 1906.

Robust, glossy dendroid plants; secondary stems bi-tripinnate, frondiform from a woody stipe, branches strongly complanate-foliate. Frond leaves lingulate, coarsely incised serrate above; costa single; cells rhomboidal, smooth. Capsules short exserted; peristome double; calyptra small, pilose.

1. HOMALIODENDRON MOHRIANUM (C. M.) Fleisch., Hedwigia **45**: 74. 1906.

Neckera Mohriana C. M., Linnaea **38**: 646. 1874.

Secondary stems 4–10 cm. long, frondiform from a stipe-like base, ultimate branches often attenuate. Stipe leaves small, scale-like,

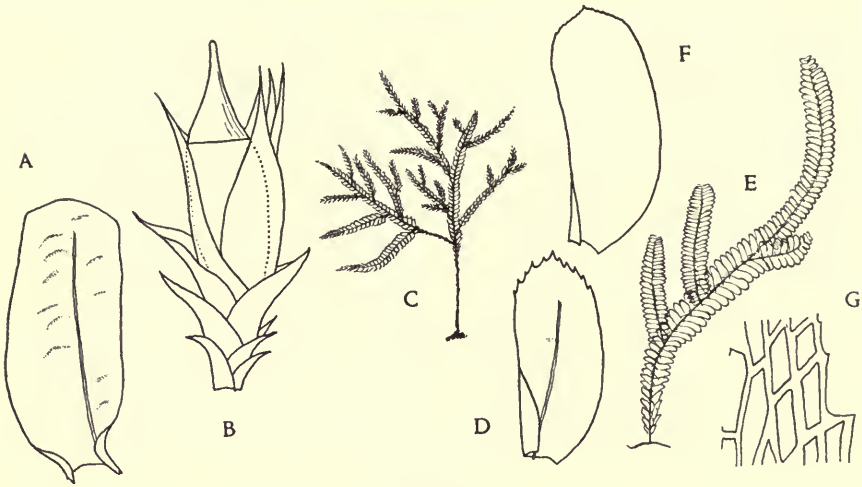

FIGURE 126

A–B, *Neckeropsis foveolata:* A, leaf, ×14; B, sporophyte, ×12.
C–D, *Homaliodendron Mohrianum:* C, plant, ×1; D, leaf, ×12.
E–G, *Homalia glabella:* E, plant, ×1; F, leaf, ×12; G, upper leaf cells and margin, ×267.

closely appressed, gradually changing to the spreading, complanate, polymorphous frond leaves which are closely spaced, lingulate, to 2.5 mm. long, distantly incised toward apex; costa slender, ending near mid-leaf; upper cells oval-rhomboidal, incrassate, gradually becoming linear toward base. Leaves of ultimate branches smaller and coarsely toothed above middle. Sporophyte not seen. (Fig. 126, C–D.)

Dept. Zacapa: *Steyermark 43229.*

Distribution: Mexico, West Indies.

On tree trunk at moderate altitude. This species is probably inseparable from *Porotrichum grandidens* C. M. of Haiti and I suspect it is also very close to if not identical with *Porotrichum decompositum* (Brid.) Mitt., although I have not had a chance to make a comparative study of authentic material.

5. HOMALIA (Brid.) Bry. Eur. fasc. **44–45.** 1850.

Omalia Brid. subgenus of *Leskea* Brid., Bryol. Univ. **2:** 325. 1827.

Plants growing in thin, lustrous mats; secondary stems prostrate, complanate-foliate, irregularly branched. Leaves appearing dis-

tichous, broad, obtusely rounded, not undulate; costa double, short; upper cells rhomboidal, becoming linear below. Seta elongate; capsules inclined; peristome double; lid conic-rostrate.

1. HOMALIA GLABELLA (Hedw.) Mitt., Journ. Linn. Soc. **12**: 458. 1869.

Leskea glabella Hedw., Sp. Musc. 235. 1801.

Dioicous; green or yellowish green glossy plants; secondary stems to 8 or 10 cm. long, about 4 mm. wide with leaves. Leaves closely spaced in 4 rows, strongly complanate, widely spreading, 2–3 mm. long, oblong-cultriform, broadly rounded, apiculate; margins plane, inflexed on one side below, serrulate in upper half; costa double, short; upper cells irregularly rhomboidal, incrassate, linear below. Seta slender, red, about 14 mm. long; capsule ovoid, inclined, urn 1.75 mm. long; peristome teeth transversely striolate, segments as long as teeth from a rather high basal membrane, cilia 1, appendiculate; spores smooth, 10–13 μ. Fruit known only from Jamaica. (Fig. 126, E–G.)

Dept. Izabal: *Steyermark 39056, 41898.* Dept. Alta Verapaz: *Standley 91483.* Dept. Quezaltenango: *Steyermark 33345.* Dept. Zacapa: *Steyermark 29853a, 29927a, 29931.*

Distribution: Mexico, Costa Rica, West Indies.

On trees and moist rocks at low to moderately high altitudes. The strongly flattened stems and broad, smooth, glossy leaves will easily identify this species once it is familiar.

EXCLUDED SPECIES

HOMALIA ANGUSTIFRONS C. M., Bull. Herb. Boiss. **5**: 203. 1897.

As no authentic material is available this species must remain in doubt.

6. PINNATELLA (C. M.) Fleisch., Hedwigia **45**: 79. 1906.

Hypnum Sect. *Pinnatella* C. M., Linnaea **39**: 456. 1875.

Plants variable in size; primary stems creeping, secondary stems erect, pinnately branched. Leaves laxly imbricated, ovate, costa stout, ending near apex; cells rounded, elongate toward base. Seta short, scabrous; capsules exserted; peristome double.

1. PINNATELLA MINUTA (Mitt.) Broth., E. & P. Pflanzenf. 1^3: 857. 1906.

Porotrichum minutum Mitt., Journ. Linn. Soc. **12**: 465. 1869.

Dioicous; slender plants; secondary stems bipinnate, to 2 cm. high, branches often flagelliform attenuate and occasionally bearing short, filiform, microphyllous branchlets. Stem leaves slightly complanate, 0.8 mm. long, lingulate from a broadly ovate base, concave, obtusely rounded, minutely denticulate toward apex; costa strong, ending 8–10 cells below apex; upper cells irregularly rounded, 8–10 μ, incrassate, dorsal surface convex, more elongate near costa toward base. Sporophyte unknown. (Fig. 127, A–C.)

Dept. Peten: *Lundell 2930.*

Distribution: Mexico, Costa Rica, Cuba.

On trees and rocks at low altitudes. This interesting little individual species may be less localized than the meager collections would indicate. It is too inconspicuous to be noticed by any but an experienced bryologist.

7. POROTRICHUM Brid., Bryol. Univ. **2**: 275. 1827.

Dioicous; primary stems creeping, secondary stems erect, dendroid, from a stipe-like base. Leaves ovate, serrate above; costa strong; basal cells elongate, becoming shorter, broader and incrassate above. Seta elongate; capsules erect or nodding; peristome double, complete.

1. Stipe leaves squarrose-spreading ..... 1. *P. plicatulum*
   Stipe leaves erect-spreading 2
2. Stem leaves 1 mm. or less long, slender plants ..... 4. *P. brevifolium*
   Stem leaves 2–2.5 mm. long, robust plants 3
3. Stems tumid ..... 5. *P. guatemalense*
   Stems complanate 4
4. Branch leaves broadly lingulate, broadly obtuse, cells short .... 3. *P. cobanense*
   Branch leaves narrowly lingulate, acute or acuminate, cells elongate 2. *P. longirostre*

1. POROTRICHUM PLICATULUM Mitt., Journ. Linn. Soc. **12**: 461. 1869.

Plants yellowish green; secondary stems slender, 2–3 cm. high, simple below, bipinnate above forming a small, triangular frond. Stipe leaves squarrose-spreading or recurved, 0.8 mm. long, tri-

angular-ovate, abruptly acuminate, channelled above. Frond leaves faintly striate when dry, complanate, about 1 mm. long, ovate-lanceolate, abruptly short acuminate; margins slightly recurved below, plane and sharply serrulate above; costa extending about $\frac{4}{5}$ up leaf, often ending in a minute dorsal tooth; cells narrow, linear-rhomboidal, minutely papillose at apical angles above. Fruit not seen. (Fig. 127, D–G.)

Dept. Alta Verapaz: *Steyermark 44426.*

Distribution: Costa Rica, Trinidad, South America.

On tree trunk at rather low altitude. A trim little plant growing horizontally from the bark and distinct from its local congeners in the squarrose stipe leaves.

2. POROTRICHUM LONGIROSTRE (Hook.) Mitt., Journ. Linn. Soc. **12:** 461. 1869.

Neckera longirostris Hook., Musc. Exot. tab. 1. 1818.

Secondary stems often robust, to 12 cm. long, freely bipinnate above in an irregular frond from a long, stipitate base, branches often long and slenderly attenuate. Stipe leaves small, distant, scariose and appressed near base, laxly spreading above. Frond

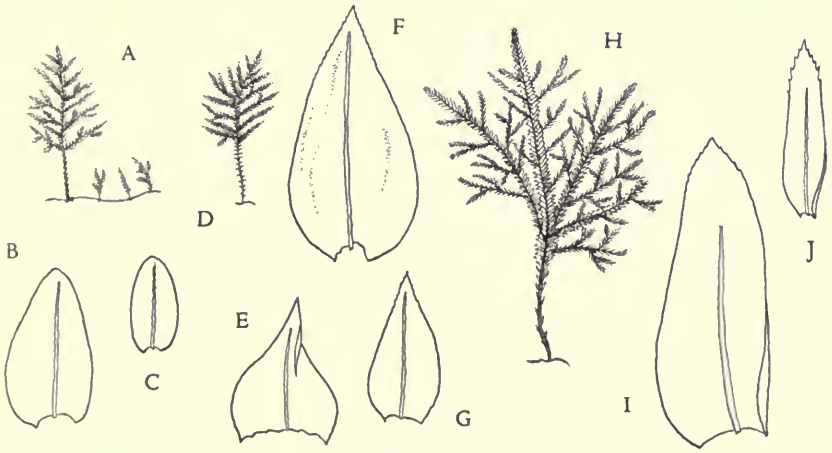

FIGURE 127

A–C, *Pinnatella minuta:* A, plant, ×1; B, stem leaf, ×26; C, branch leaf, ×26.
D–G, *Porotrichum plicatulum:* D, plant, ×1; E, stipe leaf, ×28; F, stem leaf, ×28; G, branch leaf, ×28.
H–J, *Porotrichum longirostre:* H, plant, ×1; I, stem leaf, ×14; J, branch leaf, ×14.

leaves of main stem and branches complanate, to 3 mm. long, oblong-ovate, short acuminate, serrulate above. Ultimate branch leaves smaller, narrower, sharply acuminate, coarsely serrate; costa ending far below apex; upper cells oval-rhomboidal, becoming linear below. Seta about 2.5 cm. long; capsule nodding, ovoid, urn 2 mm. long; lid beaked, erect or oblique; peristome large. (Fig. 127, H–J.)

Dept. Alta Verapaz: *Standley 71178, 71256, 71605, 71701, 91409.* Dept. San Marcos: *Standley 68556a, 68649.* Dept. Quezaltenango: *Standley 65390, 65442, 65459, 85051, 85938.* Dept. Suchitepequez: *Steyermark 46661b, 46663.* Dept. Solola: *Steyermark 46953, 47568.* Dept. Chimaltenango: *Standley 57814, 58802, 60034, 61924.* Dept. Guatemala: *Standley 58415a.* Dept. El Progresso: *Steyermark 43580.* Dept. Zacapa: *Steyermark 42650.* Dept. Chiquimula: *Steyermark 30782.*

Distribution: Costa Rica, South America.

On trees and damp banks at medium to high altitudes. A very variable species sometimes forming a compact, neat frond but more frequently with the branches irregular and slenderly attenuate. The leaves vary widely in size and shape depending upon their location in the frond but the ultimate branch leaves are always narrower, more sharply pointed and more coarsely toothed.

3. POROTRICHUM COBANENSE C. M., Bull. Herb. Boiss. **5**: 202. 1897.

Secondary stems to 6 or 7 cm. long, regularly and laxly pinnate and bipinnate from a stipe-like base or often irregularly branched and obscurely stipitate, branches broad, blunt, or seldom shortly attenuate. Stipe leaves small, scariose, laxly appressed. Stem and branch leaves similar, about 2.5 mm. long, complanate, oblong-lingulate, broadly rounded and abruptly acute, distantly and weakly serrate in upper half; costa strong, ending well above mid-leaf, often with short lateral spurs above; upper cells oval-rhomboidal, shorter than in *P. longirostre*, gradually becoming linear below. Seta 1.5 cm. long; capsule ovoid, inclined, urn 2 mm. long. (Fig. 128, A–C.)

Dept. Izabal: *Steyermark 39151.* Dept. Alta Verapaz: *Standley 71033, 90071.* Dept. San Marcos: *Standley 68651, 86328, 86501; Steyermark 35825, 35871a, 36764.* Dept. Quezaltenango: *Standley 65310, 65433a, 65478a, 67408, 67479, 67509, 67889, 67911, 68135, 68261a, 83301, 83340, 83351, 85468, 85823, 85884, 85931, 85992, 86645, 87153; Steyermark 33660, 33661, 33880, 35140, 35161.* Dept. Sacatepequez: *Standley 63695, 88960.* Dept. Escuintla: *Standley 61315.* Dept. Zacapa: *Steyermark 29927.* Dept. Jalapa: *Steyermark 32368, 32488.*

Distribution: Costa Rica, Panama.

On trees, damp banks and rocks at low to high altitudes. I distinguish this species from *P. longirostre* by the blunter branches

and broader, more abruptly pointed leaves with shorter apical leaf cells. It varies widely in habit. Some of the prostrate, scarcely dendroid forms bear little resemblance to the more typical plants but the structural details are quite uniform.

4. POROTRICHUM BREVIFOLIUM Bartr., Bryol. **49**: 117. 1946.

Slender, densely tufted, yellowish green plants without lustre. Secondary stems 4.5 cm. high, copiously and irregularly branched from near the base, branches often flagelliform attenuate. Stem leaves about 1 mm. long, complanate, distichous, oblong-lingulate, obtuse, minutely mucronate; margins plane, inflexed on one side below, weakly crenulate-denticulate above; costa weak, ending far below apex; upper cells subhexagonal with firm, pellucid walls, gradually more elongate below. Branch leaves similar but smaller, about 0.5 mm. long. (Fig. 128, D–F.)

Dept. Alta Verapaz: Vicinity of caves southwest of Lanquin, alt. 600–1,000 m., *Steyermark 44098*, TYPE.

Endemic.

On rocks around spring of cave outlet. Without any striking characters this species seems to be well distinguished by the slender

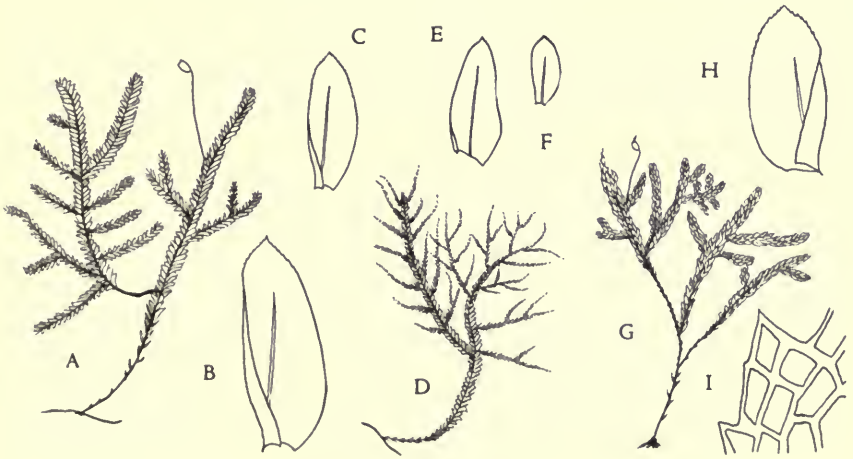

FIGURE 128

A–C, *Porotrichum cobanense:* A, plant, ×1; B, stem leaf, ×14; C, branch leaf, ×14.

D–F, *Porotrichum brevifolium:* D, plant, ×1; E, stem leaf, ×14; F, branch leaf, ×14.

G–I, *Porotrichum guatemalense:* G, plant, ×1; H, leaf, ×14; I, upper leaf cells and margin, ×267.

habit, flagelliform branchlets and the small, weakly toothed leaves rarely more than 1 mm. long.

5. POROTRICHUM GUATEMALENSE Bartr., Bryol. **49**: 117. 1946.

Robust dendroid plants, yellowish brown; secondary stems erect, to 6 cm. long, simple below, subfasciculately branched above, branches turgid, subpinnately branched, attenuate. Leaves laxly imbricated, erect-spreading on all sides, concave, oblong-ovate, acute, coarsely and irregularly serrate above; costa slender, ending about ⅔ up, not toothed on back; upper leaf cells hexagonal, gradually more elongate below, basal cells short linear or narrowly rectangular. Seta erect, flexuous, smooth, 7–8 mm. long; capsule oblong, inclined, urn 1.5 mm. long; lid obliquely conic-rostrate. (Fig. 128, G–I.)

Dept. Quezaltenango: Mountains southeast of Palestina on old road to San Juan Ostuncalco, alt. 2,550–2,850 m., *Standley 84288a*, TYPE.

Endemic.

On tree. In many respects this species approaches *P. neckeroides* (Hook.) of northwestern North America but the shorter, more slender costa, not toothed on the back, seems to be a clear diagnostic character.

EXCLUDED SPECIES

POROTRICHUM UNDULATUM C. M., Bull. Herb. Boiss. **5**: 203. 1897.

No material of this species is available for comparison.

34. LEMBOPHYLLACEAE

Plants slender to robust; secondary stems dendroid, erect or arching, irregularly pinnate and bipinnate, densely foliate, julaceous, often radiculose at tips. Branch leaves imbricated, concave; costa single or short and double; cells linear or shorter and oval, smooth. Seta elongate, smooth; capsules nodding or horizontal; lid conic-apiculate; peristome double.

Robust plants, stem leaves short pointed, cells elongate.....1. *Porotrichodendron*
Slender plants, stem leaves long acuminate, cells short.....2. *Rigodium*

1. POROTRICHODENDRON Fleisch., Laubmfl. Java **3**: 937. 1908.

Robust glossy plants; secondary stems irregularly pinnate, branches julaceous. Leaves concave, short pointed, toothed above;

costa single; cells linear, smooth, shorter and colored across insertion. Seta long, smooth; capsule ovoid, nodding; lid obliquely beaked; peristome double.

1. POROTRICHODENDRON SUPERBUM (Tayl.) Broth., E. & P. Pflanzenf. Ed. 2, **11**: 206. 1925.

Leskea superba Tayl., Lond. Journ. Bot. **5**: 61. 1846.

Secondary stems 4–12 cm. or more long, bipinnate, often proliferating from the main axis, branches terete-foliate, cuspidate at tips. Lower leaves scariose, distant, laxly appressed; upper stem leaves oblong-ovate from a broad, subcordate base, obtuse, apiculate, slightly complanate, to 2 mm. long; margins erect, serrulate toward apex; costa slender, ending well above mid-leaf; cells narrowly linear, shorter and rhomboidal near apex, short and yellowish across insertion. Branch leaves smaller. Seta elongate; capsule nodding, ovoid; lid subulate-rostrate. (Fig. 129, A–D.)

Dept. San Marcos: *Standley 86283, 86455a, 86463a.* Dept. Quezaltenango: *Standley 85073a.* Dept. Chimaltenango: *Standley 60035a, 61104a, 80159.*

Distribution: Costa Rica, South America.

On trees and damp banks at rather high altitudes. Rarely fruiting in North America but readily separated from *Porotrichum* by the proliferous stems and closely imbricated, concave, branch leaves. The transfer to *Porotrichodendron* by Brotherus was evidently made prior to the above citation but I have not been successful in locating the original publication.

2. RIGODIUM Kunz. mss., Schwaegr., Linnaea **18**: 599. 1844.

Secondary stems slender, simple and rigid below, copiously bi-tripinnately branched above, branches filiform-attenuate. Stem leaves squarrose-recurved, long acuminate. Branch leaves erect-spreading, smaller and shorter pointed, serrulate; costa nearly percurrent; cells short, smooth. Seta elongate, smooth; capsules nodding or horizontal; lid short beaked; peristome double.

1. RIGODIUM GRACILE Ren. & Card., Bull. Soc. Roy. Bot. Belg. **32**: 197. 1893.

Dioicous; plants dull yellowish green; secondary stems 2–4 cm. high, branches very numerous, often curved when dry, filiform-attenuate. Leaves dimorphous; lower stem leaves distant, squarrose-

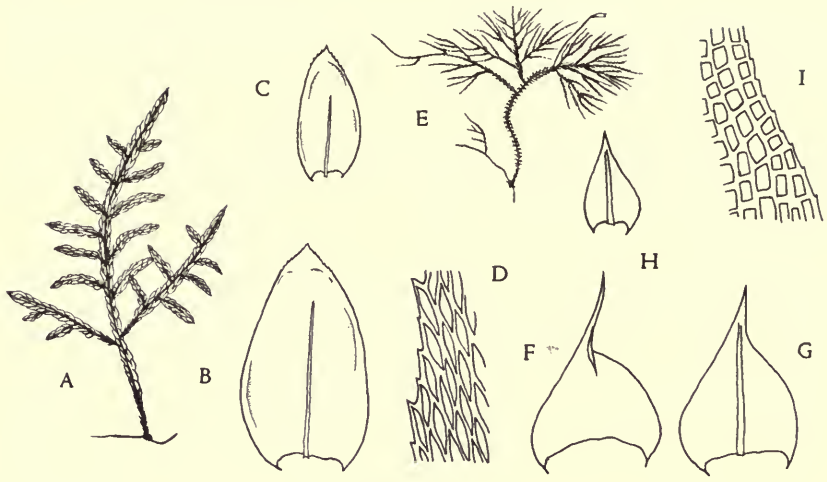

FIGURE 129

A–D, *Porotrichodendron superbum:* A, plant, ×1; B, stem leaf, ×14; C, branch leaf, ×14; D, upper leaf cells and margin, ×267.

E–I, *Rigodium gracile:* E, plant, ×1; F, lower stem leaf, ×14; G, upper stem leaf, ×14; H, branch leaf, ×14; I, upper leaf cells and margin, ×267.

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recurved, broadly deltoid, abruptly long subulate-acuminate, erose-denticulate, ecostate; upper stem leaves similar but with a well defined costa ending in acumen. Branch leaves much smaller, ovate-lanceolate, acuminate, serrulate above; costa ending in acumen below apex; cells small, irregularly hexagonal, slightly elongate near costa at base. Seta 10–15 mm. long, reddish; capsule ovoid-cylindric, contracted under the wide mouth when dry and empty, urn 1.5 mm. long. (Fig. 129, E–I.)

Dept. Suchitepequez: *Steyermark 46661a, 46662.* Dept. Jalapa: *Steyermark 32769.*

Distribution: Costa Rica.

On tree trunks at medium altitudes. This genus has nothing in common with the other genera grouped in the Lembophyllaceae and might better be placed in a separate family or included in either the Leskeaceae or Brachytheciaceae.

35. PILOTRICHACEAE

Dioicous; slender to moderately robust rigid, dull plants, laxly tufted. Primary stems creeping, secondary stems pinnate to tri-pinnate. Leaves imbricated on all sides; costa double, well developed,

ending below apex; cells uniform, parenchymatous, smooth or papillose. Seta short; capsules erect, mostly exserted; peristome double; lid short, conic-rostrate; calyptra small, conical, pilose.

1. PILOTRICHUM P. Beauv., Prodr. 37. 1805.

We have but one genus with the characters of the family.

1. Stems tripinnate, ultimate branches filiform . . . . . 4. *P. ramosissimum*
   Stems pinnate or bipinnate, branches less slender 2
2. Costa ending in a prominent dorsal spine or tooth . . . . . 3. *P. bipinnatum*
   Costa ending in lamina or minutely aculeate 3
3. Stems laxly pinnate, branches distant and few . . . . . 1. *P. amazonum*
   Stems pinnate and bipinnate, branches numerous . . . . . 2. *P. cryphaeoides*

1. PILOTRICHUM AMAZONUM Mitt., Journ. Linn. Soc. **12**: 387. 1869.

Secondary stems brownish green, laxly pinnate, branches widely spreading. Leaves 1–1.5 mm. long, ovate, concave, acute, minutely serrulate above; costa ending about ⅔ up leaf, forks often unequal, frequently ending in a minute dorsal prickle; cells narrowly oblong, incrassate, faintly papillose. Sporophyte not seen. (Fig. 130, A–C.)

Dept. Peten: *Lundell 2731b, 3332a.* Dept. Izabal: *Steyermark 39911a.*

Distribution: Mexico, Panama, Brazil.

On branches of trees at low altitudes. More laxly and distantly branched than *P. cryphaeoides* and usually with a distinct brownish tinge. The costae usually end in a minute but evident prickle on the dorsal tips.

2. PILOTRICHUM CRYPHAEOIDES Besch., Ann. Sci. Nat. Ser. 6, **3**: 219. 1876.

Secondary stems dull green, to 5–6 cm. long, often proliferous, usually pinnate but frequently bipinnate, branches numerous, about 1 cm. long. Leaves 1 mm. long or slightly longer, ovate, concave, acute, serrulate above; costa ending well above mid-leaf, forks unequal, not aculeate at tips; cells as in *P. amazonum*. Seta 1.5–2 mm. long, slightly curved; capsule oblong, urn 1 mm. long. (Fig. 130, D–F.)

Dept. Quezaltenango: *Steyermark 33512.* Dept. Suchitepequez: *Steyermark 35291.*

Distribution: British Honduras, Guadeloupe, Martinique, Tobago.

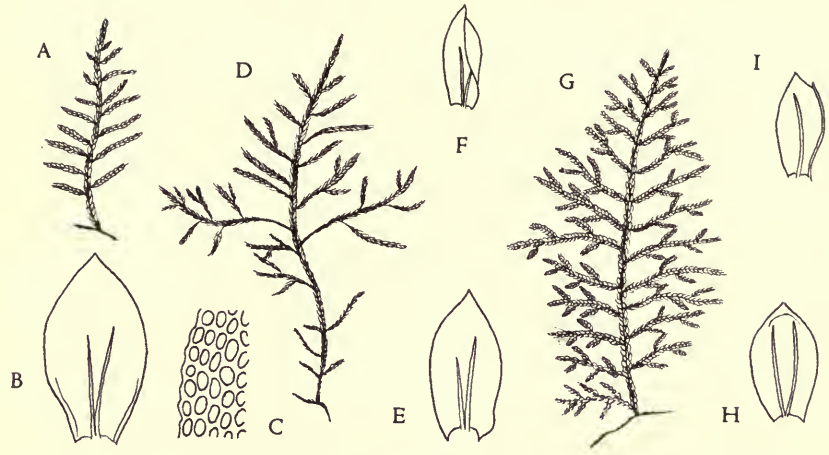

FIGURE 130

A–C, *Pilotrichum amazonum:* A, plant, ×1; B, leaf, ×24; C, upper leaf cells and margin, ×267.

D–F, *Pilotrichum cryphaeoides:* D, plant, ×1; E, stem leaf, ×14; F, branch leaf in profile, ×14.

G–I, *Pilotrichum bipinnatum:* G, plant, ×1; H, stem leaf, ×14; I, branch leaf in profile, ×14.

On forest trees and logs at medium altitudes. Very near *P. amazonum* but I think distinct in color and especially the more freely branched, proliferous and often bipinnate stems.

3. PILOTRICHUM BIPINNATUM (Schwaegr.) Brid., Bryol. Univ. **2**: 263. 1827.

Neckera bipinnata Schwaegr., Suppl. 1[2]: 156. 1816.

Plants pale green, secondary stems to 8 or 10 cm. long but usually shorter, freely bipinnate from near base, branches to 2 or 3 cm. long, with numerous branchlets. Leaves arched when dry, with incurved points, imbricated when moist. Stem leaves about 1 mm. long, concave, broadly ovate, obtuse, minutely apiculate; branch leaves smaller, acute, costae strong, extending nearly to base of acumen, ending in prominent dorsal spines at tips and often bearing clusters of brood filaments on back; margins narrowly recurved below, serrulate above; cells narrowly oblong, incrassate, smooth. Seta 1–2 mm. long; capsule exserted, urn 1 mm. long, oblong-ovoid; calyptra sparingly pilose. (Fig. 130, G–I.)

Dept. Izabal: *Steyermark 38188, 38905, 41879b.* Dept. Alta Verapaz: *Steyermark 44814; Standley 91622a.*

Distribution: Nicaragua, Panama, West Indies, South America.

On trees at relatively low altitudes. Although variable in habit the slender, decompound branching and the conspicuous dorsal spines at the tips of the costae will identify this species without much trouble.

4. PILOTRICHUM RAMOSISSIMUM Mitt., Journ. Linn. Soc. **12**: 388. 1869.

?Eupilotrichum filigranum C. M., Bull. Herb. Boiss. **5**: 204. 1897.

Plants very slender, pale green at tips, brown below; secondary stems to 5 cm. long, often proliferous, copiously tripinnate from a stipe-like base, ultimate branches filiform. Leaves of main axis 1.5 mm. long, broadly ovate from a cordate base, obtuse, decreasing rapidly in size to the ultimate branchlets where the leaves are only 0.4 mm. long, ovate, obtuse, concave; costae prominent at back, ending in a prominent dorsal spine and toothed near tip, extending about ¾ up leaf; cells small, oval-rhomboidal, minutely papillose. Capsule exserted on a short seta. (Fig. 131, A–C.)

Dept. Alta Verapaz: *Standley 71701a.*

Distribution: Costa Rica, Colombia.

On tree at moderate altitude. These plants strongly resemble *Thuidium* in habit. I have not seen the type of *Eupilotrichum filigranum* but the description suggests beyond much doubt that it belongs here.

EXCLUDED SPECIES

EUPILOTRICHUM FASCICULATUM C. M., Bull. Herb. Boiss. **5**: 204. 1897.

No material is available for study. The description suggests *P. bipinnatum* but there is a large element of doubt.

36. HOOKERIACEAE

Small to robust, often flaccid plants with branched, often flattened stems. Leaves variable, frequently bordered; costa single, double or lacking, usually ending well below apex; cells smooth or papillose, often wide and lax, alar group not differentiated. Seta elongate, smooth or scabrous; capsules inclined or horizontal, rarely erect;

peristome double, teeth often with a median furrow; calyptra mitriform, usually lobed or fringed at base, scabrous or pilose.

1. Costa single 2
   Costa double or none 4
2. Leaves not bordered ..... 3. *Adelothecium*
   Leaves bordered with elongated cells 3
3. Leaves uniform, narrowly lanceolate, acuminate ..... 1. *Daltonia*
   Leaves ovate, apiculate, lateral rows differentiated ..... 2. *Leskeodon*
4. Costa lacking 5
   Costa double, well developed 9
5. Leaves entire 6
   Leaves toothed 7
6. Leaves short pointed, cells rhomboidal ..... 4. *Hookeria*
   Leaves long acuminate, cells linear ..... 13. *Philophyllum*
7. Leaves acuminate, coarsely serrate above ..... 12. *Rhynchostegiopsis*
   Leaves short pointed, denticulate 8
8. Leaves asymmetrical, cells linear, marginal teeth single .... 10. *Isodrepanium*
   Leaves symmetrical, cells hexagonal, marginal teeth often bifid 11. *Crossomitrium*
9. Leaves strongly plicate ..... 14. *Harpophyllum*
   Leaves not plicate 10
10. Peristome papillose, with a median zig-zag line 11
    Peristome teeth striolate, with a median furrow 12
11. Seta smooth, slender, elongate, leaves uniform ..... 8. *Actinodontium*
    Seta papillose or setose, often short, lateral leaves differentiated 9. *Lepidopilum*
12. Leaves bordered with narrow cells ..... 5. *Cyclodictyon*
    Leaves not bordered 13
13. Leaf cells oval-hexagonal, often papillose ..... 6. *Callicostella*
    Leaf cells elongate or linear, smooth ..... 7. *Hookeriopsis*

1. DALTONIA Hook. & Tayl., Musc. Brit. 80. 1818.

Mostly autoicous; small, often glossy plants, tufted. Stems laxly erect, simple or forked, scarcely flattened. Leaves uniform, crowded, lanceolate, bordered; costa single, ending in upper ¼ of leaf; cells oval, smooth, linear at margins. Setae lateral, often scabrous above; capsules suberect; peristome teeth papillose; calyptra fringed at base.

1. Leaf margin flat ..... 1. *D. longifolia*
   Leaf margin recurved 2
2. Seta smooth ..... 2. *D. tenuifolia*
   Seta scabrous above ..... 3. *D. gracilis*

1. DALTONIA LONGIFOLIA Tayl., Lond. Journ. Bot. **7**: 284. 1848.

Plants yellowish green; stems to 2.5 cm. high. Leaves crowded, spirally contorted when dry, 2.5–3.5 mm. long, oblong-ligulate, acuminate; margins plane, minutely denticulate above, border sharply defined, 4 rows wide at mid-leaf; costa ending about $\frac{4}{5}$ up leaf; upper cells oval, more lax and oblong below. Seta 10–12 mm. long, scabrous above; capsule erect, 1.5 mm. long; lid beaked; calyptra scabrous above, fringed at base. (Fig. 131, D–F.)

Dept. Alta Verapaz: *Turckheim 6660, 6661, 6662.* Dept. Quezaltenango: *Standley 85089.*

Distribution: Mexico, West Indies, South America, Galapagos Islands.

On leaves with hepatics at rather high altitude. Well marked by the flat leaf margins.

2. DALTONIA TENUIFOLIA Mitt., Journ. Linn. Soc. **12**: 402. 1869.

Slender plants growing in small tufts; stems to 7 mm. high. Leaves crowded, erect, flexuous when dry, to 2.5 mm. long, linear-lanceolate, slenderly acuminate; margins narrowly revolute below,

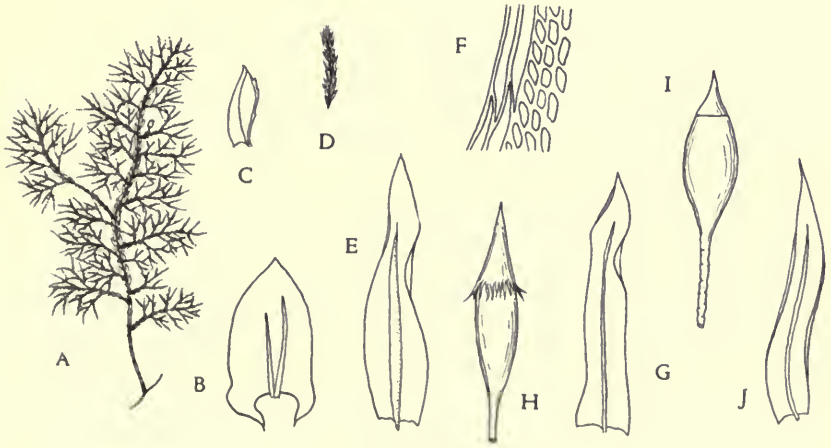

FIGURE 131

A–C, *Pilotrichum ramosissimum:* A, plant, ×1; B, stem leaf, ×14; C, branch leaf in profile, ×14.

D–F, *Daltonia longifolia:* D, plant, ×1; E, leaf, ×14; F, upper leaf cells and margin, ×267.

G–H, *Daltonia tenuifolia:* G, leaf, ×14; H, capsule, ×10.

I–J, *Daltonia gracilis:* I, capsule, ×10; J, leaf, ×14.

flat and entire above, border narrow; costa ending $\frac{4}{5}$ up leaf; upper cells oval-hexagonal, more lax, linear-oblong, hyaline and delicate at base. Seta smooth, 4–6 mm. long; capsule erect, ovoid; calyptra smooth above, deeply fringed at base. (Fig. 131, G–H.)

Dept. Sacatepequez: *Standley 88961e.*

Distribution: Costa Rica, Ecuador, Bolivia.

On tree at medium altitude. The smooth setae are distinctive.

3. DALTONIA GRACILIS Mitt., Journ. Linn. Soc. **12**: 402. 1869.

Small, slender, tufted plants, similar to *D. tenuifolia* but distinguished by the setae scabrous above or sometimes nearly half way down; calyptra slightly roughened above, fringed. (Fig. 131, I–J.)

Dept. Sacatepequez: *Standley 66941a.*

Distribution: Costa Rica, Panama, South America.

On Guadna sheaths at relatively low altitude. Broadly distributed but seldom collected independently as the small tufts are usually mixed with other mosses or hepatics and are likely to escape the notice of anyone but an experienced field bryologist.

EXCLUDED SPECIES

DALTONIA LONGO-CUSPIDATA C. M., Bull. Herb. Boiss. **5**: 201. 1897.

See note in Bull. Torr. Bot. Club **58**: 46. 1931.

2. LESKEODON Broth., E. & P. Pflanzenf. 1^3: 925. 1907.

Soft, pale green plants growing in thin mats. Stems short, simple or forked, complanate-foliate. Leaves somewhat dimorphous, dorsal and ventral rows erect, lateral rows spreading, ovate-spatulate, short pointed, entire, narrowly bordered; costa single; cells hexagonal, smooth. Seta slender, often scabrous above; capsules erect or nodding, minute, ovoid; peristome teeth papillose; lid beaked; calyptra fringed at base.

A well marked genus with the gametophyte of Distichophyllum and the sporophyte of Daltonia.

Leaf apiculus very short, basal leaf cells firm ..... 1. *L. andicola*
Leaf apiculus longer, basal cells lax ..... 2. *L. mexicanus*

1. LESKEODON ANDICOLA (Spruce) Broth., E. & P. Pflanzenf. **1**[3]: 926. 1907.

Distichophyllum andicola Spruce, MS. in Journ. Linn. Soc. **12**: 395. 1869.

Autoicous; stems 5–10 mm. long, 3 mm. wide with leaves, complanate-foliate. Lateral leaves 2 mm. long, slightly contorted when dry, oblong-ovate, abruptly short apiculate, entire, narrowly bordered all around with one row of long, narrow cells; costa ending about ¾ up leaf; cells rounded-hexagonal, 18–20 μ in diameter near costa, smaller toward margins, larger and oblong-hexagonal toward base. Dorsal and ventral rows erect, similar but smaller. Seta very slender, 2–3.5 mm. long; capsule nodding, ovoid, urn 0.5 mm. long; calyptra fringed at and near base, sparingly pilose above. (Fig. 132, A–D.)

Dept. Izabal: *Steyermark 39075* (as *L. pusillum* (Mitt.) Broth.).

Distribution: Costa Rica, Cuba, South America.

On bark of tree at low altitude. *Distichophyllum cubense* Mitt. is in all probability a form of this species and as the leaf apex varies considerably in outline even on the same stem I suspect that *D. pusillum* Mitt. may prove to be in the same form circle.

2. LESKEODON MEXICANUS Card., Rev. Bryol. **38**: 41. 1911.

Plants similar in size, habit and coloring to *L. andicola* but leaves long apiculate, bordered with two rows of elongated cells; basal leaf cells very lax, with thin, delicate walls. (Fig. 132, E–F.)

Dept. Alta Verapaz: *Standley 71632a.*

Distribution: Mexico.

On log in wet forest at moderate altitude. The distinctions between this species and *L. andicola* are none too convincing but the few plants segregated under the above number show the leaves uniformly longer pointed.

3. ADELOTHECIUM Mitt., Journ. Linn. Soc. **12**: 391. 1869.

Dioicous; robust golden brown plants, densely tufted. Stems ascending, very flat, forked, often ending in a short, curved, microphyllous, caudate tip. Leaves ovate, short pointed, unbordered; costa strong, nearly percurrent; cells rounded, smooth. Seta short; capsules erect, exserted; peristome teeth pellucid, endostome lacking; calyptra plicate, lobed at base, pilose below.

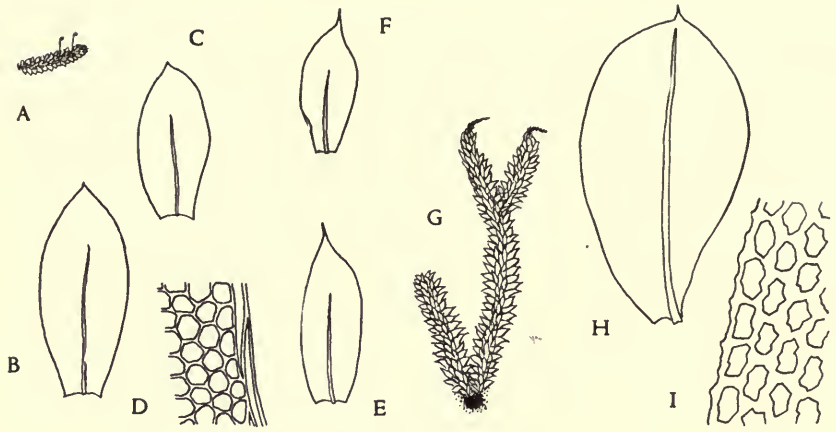

FIGURE 132

A–D, *Leskeodon andicola:* A, plant, ×1; B, lateral leaf, ×14; C, median leaf, ×14; D, upper leaf cells and margin, ×267.

E–F, *Leskeodon mexicanus:* E, lateral leaf, ×14; F, median leaf, ×14.

G–I, *Adelothecium bogotense:* G, plant, ×1; H, lateral leaf, ×10; I, upper leaf cells and margin, ×267.

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1. ADELOTHECIUM BOGOTENSE (Hampe) Mitt., Journ. Linn. Soc. **12**: 391. 1869.

Hookeria bogotensis Hampe, Ann. Sci. Nat. Ser. 5, **5**: 303. 1865.

Stems 3–4 cm. long, 5–6 mm. wide, often horizontally spreading from tree trunks. Leaves ovate from a narrow, asymmetrical, slightly decurrent base, 3–4 mm. long, 1.5–2 mm. wide, abruptly apiculate; margins flat, minutely crenulate; costa ending in apiculus; cells small, irregularly rhomboidal, incrassate, smooth, linear and porose near costa at base. Very rarely fruiting, sporophyte not seen. (Fig. 132, G–I.)

Dept. Alta Verapaz: *Standley 89996*. Dept. El Progresso: *Steyermark 43485*. Dept. Zacapa: *Steyermark 43228*. Dept. Jalapa: *Steyermark 32769a*.

Distribution: Mexico, Costa Rica, West Indies, South America.

On tree trunks at medium to high altitudes. Highly individual and easily known by the robust, flattened stems with the leaves unaltered when dry and the small, caudate tips which are usually present.

4. HOOKERIA Sm., Trans. Linn. Soc. **9**: 276. 1808.

Soft, pale green plants in flat mats. Stems complanate-foliate. Leaves large, ecostate, entire; cells large and lax. Seta elongate,

smooth; capsules inclined, ovoid; lid beaked; peristome double, endostome lacking cilia.

1. HOOKERIA ACUTIFOLIA Hook., in Schwaegr., Suppl. 2^2: 36. 1826.

Dioicous; stems usually simple, 8–10 mm. wide, fragile. Leaves 3–4 mm. long, ovate-lanceolate, acute, entire, often radiculose at tips; cells oblong-hexagonal, thin walled, 50–60 μ wide, the marginal row more elongated. Seta 1–2 cm. long; capsule subpendulous, urn 1–2 mm. long; lid long beaked. (Fig. 133, A–C.)

Dept. San Marcos: *Steyermark 36400.* Dept. Quezaltenango: *Standley 65338, 65367a, 85994a.*

Distribution: Eastern United States, Costa Rica, West Indies, South America, India, Ceylon, Java.

On moist banks at high altitudes. The leaf cells are large enough to be plainly defined under a hand lens.

5. CYCLODICTYON Mitt., Journ. Linn. Soc. **7**: 163. 1864.

Medium sized, soft plants, without lustre, growing in thin mats. Stems prostrate, branched, flattened. Leaves complanate, oblong-ovate, bordered; cells large and lax, smooth; costa double, ending above mid-leaf. Seta elongate, smooth; capsules horizontal; peristome teeth striolate, furrowed along median line; calyptra naked.

1. Leaf border wide, 5–6 cells wide above ..... 2. *C. roridum*
   Leaf border narrow, 1–3 cells wide above 2
2. Leaves short acuminate, cells mostly isodiametrical ..... 1. *C. albicans*
   Leaves long acuminate, cells longer than wide 3
3. Plants yellowish or brown, leaves oblong, costae toothed on back 3. *C. rubrisetum*
   Plants purplish, leaves wider, costae smooth ..... 4. *C. erubescens*

1. CYCLODICTYON ALBICANS (Hedw.) Broth., E. & P. Pflanzenf. 1^3: 935. 1907.

Hypnum albicans Hedw., Sp. Musc. 251. 1801.

Autoicous; stems pale green, 2–3 cm. long, 2.5–3 mm. wide. Lateral leaves 1.5 mm. long, oblong-ovate, abruptly short acuminate, narrowly bordered with 1–3 rows of elongated cells, serrulate toward apex; costae ending about $\frac{4}{5}$ up, weakly toothed on back toward tips; cells rounded-hexagonal, 25–45 μ in diameter, thin walled,

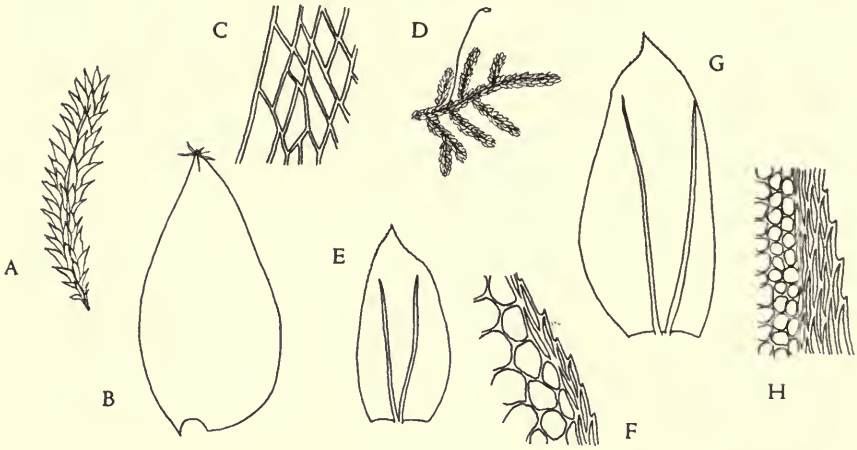

FIGURE 133

A–C, *Hookeria acutifolia:* A, plant, ×1; B, leaf, ×8; C, upper leaf cells and margin, ×53.

D–F, *Cyclodictyon albicans:* D, plant, ×1; E, leaf, ×16; F, upper leaf cells and margin, ×107.

G–H, *Cyclodictyon roridum:* G, leaf, ×16; H, upper leaf cells and margin, ×107.

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more lax and oblong near base. Seta 12–18 mm. long, reddish; capsule horizontal, ovoid with a tapering neck, constricted under mouth when dry; calyptra small, naked, lobed at base. (Fig. 133, D–F.)

Dept. Izabal: *Steyermark 39063, 39272, 41781, 41866a, 41899.* Dept. Alta Verapaz: *Standley 70728, 91520; Steyermark 45553.* Dept. Retalhuleu: *Standley 87194, 87205.* Dept. Sacatepequez: *Standley 58958, 58985, 58987.* Dept. Escuintla: *Standley 89531.*

Distribution: Mexico, West Indies, Central and South America.

On wet banks, logs and rocks at low altitudes. Until a critical revision of the tropical American species is made the species concepts must remain obscure. *C. albicans* as broadly interpreted probably includes *C. humectatum* Card. in addition to a number of poorly delimited species. The leaf cells are isodiametrical but not uniform in size; the border and the serrulation also vary considerably but the modifications seem trivial and unstable.

2. CYCLODICTYON RORIDUM (Hampe) Broth., E. & P. Pflanzenf. **1**[3]: 935. 1907.

Hookeria rorida Hampe, Linnaea **32**: 155. 1863.

Hookeria riparia Mitt., Journ. Linn. Soc. **12**: 345. 1869.

Autoicous; brownish green plants; stems to 5–6 cm. long, sparingly branched. Leaves crowded, shrunken and contorted when dry, 2–2.5 mm. long, oblong-ovate, short acuminate, broadly bordered with 5–6 rows of narrow cells, denticulate above; costae strong, extending about $\frac{4}{5}$ up, one fork often merging with the border cells, smooth on back; cells rounded-hexagonal, about 25 μ in diameter toward apex, laxer, oblong and hyaline below. Seta short; capsule inclined, ovoid; lid conic-rostrate; calyptra lobed at base (sporophyte not seen). (Fig. 133, G–H.)

Dept. San Marcos: *Steyermark 36902.*

Distribution: Porto Rico, Colombia, Ecuador.

On wet rocks at high altitudes. The broadly bordered leaves and strong, smooth costae seem to define this species adequately. *H. riparia* as represented by Spruce No. 593 differs in no essential details from *C. roridum* as far as I can see.

3. CYCLODICTYON RUBRISETUM (Mitt.) Broth., E. & P. Pflanzenf. 1^3: 936. 1907.

Hookeria rubriseta Mitt., Journ. Linn. Soc. **12**: 341. 1869.

Dioicous; plants pale green; stems prostrate, 1–3 cm. long, 3 mm. wide. Leaves contorted when dry, oblong, abruptly slenderly acuminate, narrowly bordered with 2–3 rows of elongated cells, sharply serrulate above; costae slender, extending $\frac{4}{5}$ up, toothed on back toward tips; cells oval-hexagonal, about 25 μ wide, 50 μ long, slightly larger toward base. Seta stout, red, 10–15 mm. long; capsule ovoid, inclined. (Fig. 134, A–C.)

Dept. Quezaltenango: *Standley 85061.*

Distribution: Costa Rica, Colombia.

On log at rather high altitude. Distinguished by the slenderly acuminate leaves with the upper cells twice as long as wide.

4. CYCLODICTYON ERUBESCENS Bartr., Bryol. **49**: 118. 1946.

Glossy plants with a deep reddish purple tinge, growing in lax mats. Stems about 2 cm. long, irregularly branched, branches short, obtuse, 3 mm. wide with leaves. Leaves flexuous when dry, crowded, 2–2.5 mm. long, oblong-lanceolate, narrowed to a long, slender point, bordered with about 3 rows of linear cells, entire; costa double, the forks slightly divergent and ending far below base of acumen, smooth on the back; cells lax and smooth, oval-hexagonal above, to 50 μ

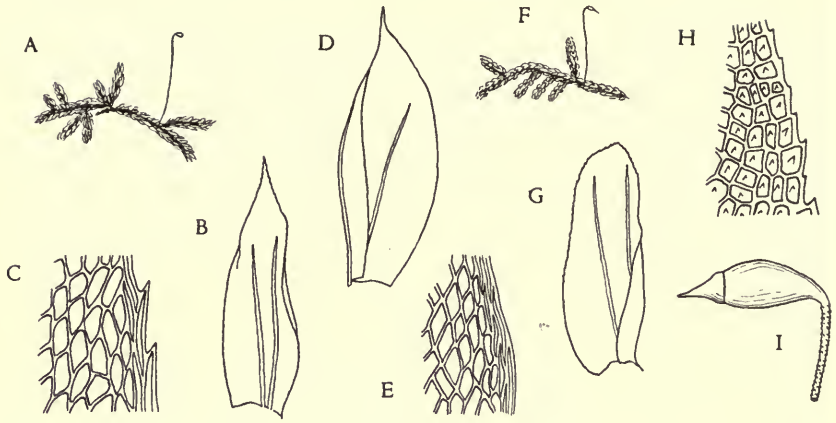

FIGURE 134

A–C, *Cyclodictyon rubrisetum:* A, plant, ×1; B, leaf, ×16; C, upper leaf cells and margin, ×107.

D–E, *Cyclodictyon erubescens:* D, leaf, ×16; E, upper leaf cells and margin, ×107.

F–I, *Callicostella pallida:* F, plant, ×1; G, leaf, ×28; H, upper leaf cells and margin, ×267; I, capsule, ×10.

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long, gradually becoming rectangular below. Sporophyte unknown. (Fig. 134, D–E.)

Dept. Huehuetenango: Cerro Victoria, Sierra de los Cuchumatanes, near Barillas, alt. 1,800–2,000 m., *Steyermark 49760*, TYPE.

Endemic.

Distinct from *C. rubrisetum* in the red coloration, wider entire leaves and the costae smooth on the back.

6. CALLICOSTELLA (C. M.) Mitt., Journ. Linn. Soc. Suppl. **1** (Musc. Ind. Or.): 136. 1859.

Hookeria Sec. *Callicostella* C. M., Syn. **2**: 216. 1851.

Plants resembling *Cyclodictyon* but less delicate. Stems prostrate, branched, complanate-foliate. Leaves oblong, short pointed, serrulate above, not bordered; costa double; cells small, oval, usually papillose. Seta elongate, smooth or papillose; capsules horizontal; peristome as in Cyclodictyon; calyptra usually scabrous, lobed at base.

1. Seta scabrous, leaf cells unipapillate.....1. *C. pallida*
   Seta smooth, leaf cells smooth.....2
2. Leaves acuminate, costae ending well below apex.....2. *C. Bernoullii*
   Leaves broadly rounded or minutely mucronate, costae ending near apical margins.....3. *C. Vatteri*

1. CALLICOSTELLA PALLIDA (Hornsch.) Jaeg., Adumb. **2**: 257. 1876–77.

Hookeria pallida Hornsch., Fl. Bras. **1**: 64. 1840.

Autoicous; stems 2–3 cm. long, rather freely branched, 1.5 mm. wide. Leaves flexuous with incurved points when dry, oblong, obtusely rounded or minutely apiculate, serrulate about half way down, about 1 mm. long; costae ending near apex, toothed on back above; cells small and dense, hexagonal, sharply unipapillate, becoming oblong, smooth and pellucid near base. Seta about 1 cm. long, scabrous throughout; capsule ovoid, urn 1 mm. long. (Fig. 134, F–I.)

Dept. Peten: *Lundell 2589b; Bartlett 12598.* Dept. Izabal: *Steyermark 41779.* Dept. Alta Verapaz: *Standley 91478.* Dept. Quezaltenango: *Standley 68229.*

Distribution: Mexico, West Indies, Central and South America.

On logs and wet banks at medium altitudes. Widely distributed and probably rich in synonymy.

2. CALLICOSTELLA BERNOULLII (C. M.) Broth., E. & P. Pflanzenf. 1^3: 937. 1907.

Hookeria Bernoullii C. M., Bull. Herb. Boiss. **5**: 207. 1897.

Autoicous; slender, yellowish green plants in dense, intricate mats. Stems 1–2 cm. long, 2 mm. wide. Leaves crispate when dry, 1–1.3 mm. long, oblong, concave, abruptly short acuminate, serrulate above; costae ending in a dorsal prickle some distance below apical margins; cells smooth, oval-hexagonal above, oblong below. Seta slender, smooth, 8–11 mm. long; capsule nodding or horizontal, ovoid, urn 1.5 mm. long. (Fig. 135, A–D.)

Dept. Peten: *Steyermark 45381.* Dept. Alta Verapaz: *Steyermark 45209.*

Endemic.

On logs at low altitudes. No type material is available for comparison but these collections correspond closely to the original description.

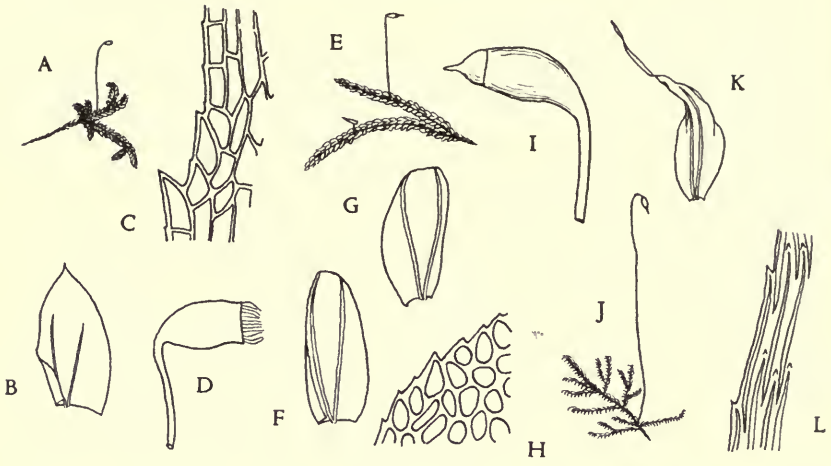

FIGURE 135

A–D, *Callicostella Bernoullii:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×267; D, capsule, ×10.

E–I, *Callicostella Vatteri:* E, plant, ×1; F and G, leaves, ×14; H, apical leaf cells and margin, ×267; I, capsule, ×8.

J–L, *Hookeriopsis subfalcata:* J, plant, ×1; K, leaf, ×16; L, upper leaf cells and margin, ×267.

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3. CALLICOSTELLA VATTERI Bartr., Bryol. **49**: 118. 1946.

Autoicous; dull yellowish green plants in rather lax tufts. Stems 2–3 cm. long, irregularly branched, branches short, blunt, complanate-foliate, about 2.5 mm. wide with leaves. Leaves contorted when dry, spreading when moist, 1.5 mm. long, oblong, obtusely rounded, serrulate at apex with projecting cells; costa double, stout, ending in or near margins very close to apex, slightly toothed on back near tips; cells smooth, incrassate, the upper oval-hexagonal, irregular in shape, longest diameter 12–20 μ, basal cells rectangular. Seta smooth, 15 mm. long; capsule horizontal, narrowly ovoid, urn about 1.5 mm. long; lid long conic-rostrate. (Fig. 135, E–I.)

Dept. Zacapa: Trail between Rio Hondo and waterfall, alt. 250–400 m., *Steyermark 29473*, TYPE.

Endemic.

Moist rocky slopes near hydro-electric station. A very individual species for the genus in the smooth leaf cells, smooth seta and the stout costae ending in or near the apical leaf margins. It is suggestive of *Pilotrichidium callicostatum* (C. M.) but is distinct in the larger, pellucid leaf cells and the coarsely serrate leaf apex.

In view of the time and effort devoted to field work on the Guatemalan mosses by Mr. A. E. Vatter, who accompanied Dr. Steyermark on his last expedition, I take pleasure in associating his name with this unusual species.

EXCLUDED SPECIES

HOOKERIA FALLAX C. M., Bull. Herb. Boiss. **5**: 207. 1897.

No material is available for study.

7. HOOKERIOPSIS (Besch.) Jaeg., Adumb. **2**: 262. 1874–75.

Hookeria subg. *Hookeriopsis* Besch., Ann. Sci. Nat. Ser. 6, **3**: 240. 1876.

Slender to rather robust plants growing in dense mats. Stems prostrate, branched, complanate-foliate. Leaves ovate-lanceolate, unbordered, usually serrate above; costa double, ending above mid-leaf; cells narrowly hexagonal to linear, smooth or papillose at apical angles. Seta elongate, usually smooth; capsules nodding or horizontal; peristome double, teeth with a median furrow, endostome lacking cilia; lid slenderly beaked; calyptra naked, lobed at base.

1. Leaves obtuse ..... 5. *H. incurva*
   Leaves acute or acuminate 2
2. Leaves falcate-secund, filiform-acuminate ..... 1. *H. subfalcata*
   Leaves erect-spreading, acumen shorter 3
3. Cells narrowly linear ..... 3. *H. angustiretis*
   Cells shorter and broader 4
4. Cells linear-rhomboidal, leaf margins densely and coarsely serrate with paired teeth ..... 2. *H. Crugeriana*
   Cells oval-hexagonal, margins less strongly serrate ..... 4. *H. guatemalensis*

1. HOOKERIOPSIS SUBFALCATA (Hampe) Jaeg., Adumb. **2**: 266. 1876–77.

Hookeria subfalcata Hampe, Ann. Sci. Nat. Ser. 5, **5**: 305. 1866.

Autoicous; slender yellowish green plants; stems 2–3 cm. long, freely branched. Leaves crowded, falcate-secund, 1.5 mm. long, narrowly ovate-lanceolate, long and finely acuminate, denticulate above; costae extending well into acumen; cells linear, sharply papillose at apical angles above, smooth below. Seta 2.5 cm. long, red; capsule horizontal, urn 1.5 mm. long; lid conic-rostrate, 1.2 mm. long. (Fig. 135, J–L.)

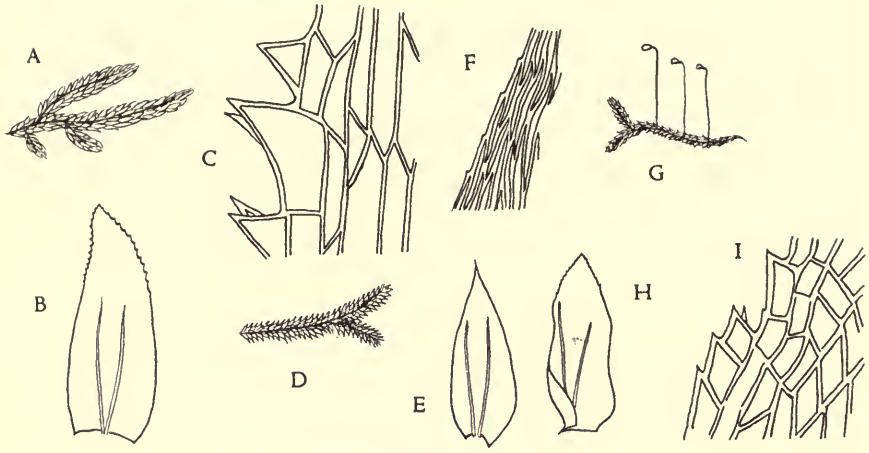

FIGURE 136

A–C, *Hookeriopsis Crugeriana:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×267.

D–F, *Hookeriopsis angustiretis:* D, plant, ×1; E, leaf, ×14; F, upper leaf cells and margin, ×267.

G–I, *Hookeriopsis guatemalensis:* G, plant, ×1; H, leaf, ×14; I, upper leaf cells and margin, ×267.

Dept. Huehuetenango: *Steyermark 48790.* Dept. Chiquimula: *Steyermark 31018, 31019.*

Distribution: Costa Rica, Colombia.

On trees and damp ground at moderately high altitudes. The slender habit and narrow, finely acuminate, falcate leaves distinguish this species at a glance.

2. HOOKERIOPSIS CRUGERIANA (C. M.) Jaeg., Adumb. **2**: 263. 1876–77.

Hookeria Crugeriana C. M., Syn. **2**: 208. 1851.

Dioicous; plants yellowish green, glossy; stems to 3 cm. long, about 3 mm. wide. Leaves crowded, erect to slightly spreading, not undulate, 2 mm. long, oblong-lanceolate, concave, obtusely acute, coarsely serrate above middle with bifid teeth; costae ending well above mid-leaf, serrate on back toward tips; cells linear, smooth, shorter across insertion. Seta 2 cm. long; capsule horizontal, ovoid-cylindric, contracted under mouth, urn 2 mm. long. (Fig. 136, A–C.)

Dept. Quezaltenango: *Standley 65306a.*

Distribution: Colombia, Trinidad, Barbados.

On wet bank at high altitude. Not recorded before from Central America as far as I know.

3. HOOKERIOPSIS ANGUSTIRETIS Bartr., Bryol. **49**: 119. 1946.

Plants bright green, slightly glossy; stems elongate, sparsely branched, 3 mm. wide with leaves, complanate-foliate. Leaves slightly rugose when dry, widely spreading when moist, ovate-lanceolate, acuminate, not at all constricted at apex; margins minutely denticulate above, entire below; costae smooth on back, ending some distance below base of acumen; cells narrowly linear, smooth. Sporophyte unknown. (Fig. 136, D–F.)

Dept. Alta Verapaz: Montana Yxocubvain, 2½ miles west of Cubilguitz, alt. 300–500 m., *Steyermark 44970*, TYPE.

Endemic.

Hanging from vertical bluff. This species seems to be near *H. laevinervis* Ren. & Card. of Costa Rica but differs appreciably in the ovate-lanceolate leaves not constricted at the apex, the longer acumination and narrower and longer leaf cells.

4. HOOKERIOPSIS GUATEMALENSIS Bartr., Bryol. **49**: 120. 1946.

Dull brownish green plants in densely interwoven mats; stems 3–4 cm. long, irregularly branched, complanate-foliate, 2.5 mm. wide with leaves. Leaves crispate when dry, erect-spreading when moist, not undulate, broadly oblong-ovate, very shortly acute, 1.5 mm. long, 0.8 mm. wide; margins coarsely dentate above, teeth often bifid; costa double, ending far below apex, sparingly toothed on back near the tips; upper leaf cells smooth, irregularly oval-hexagonal, longest diameter 20–25 μ, gradually more elongate below, basal cells rectangular. Seta 10–12 mm. long, smooth, curved at tip; capsule horizontal or subpendulous, ovoid from a short neck, brown urn 1 mm. long; lid conic-rostrate; calyptra laciniate at base, scabrous toward the tip. (Fig. 136, G–I.)

Dept. Izabal: Between Bananera and "La Presa" in Montana del Mico, alt. 40–300 m., *Steyermark 38243*, TYPE; also *38907*.

Endemic.

On logs and living trees. Near *H. diffusa* (Wils.) but leaves more broad and not undulate and setae shorter.

5. HOOKERIOPSIS INCURVA (Hook. & Grev.) Broth., E. & P. Pflanzenf. **1**[3]: 942. 1907.

Hookeria incurva Hook. & Grev., Brewst. Edinb. Journ. **2**: 231. 1825.

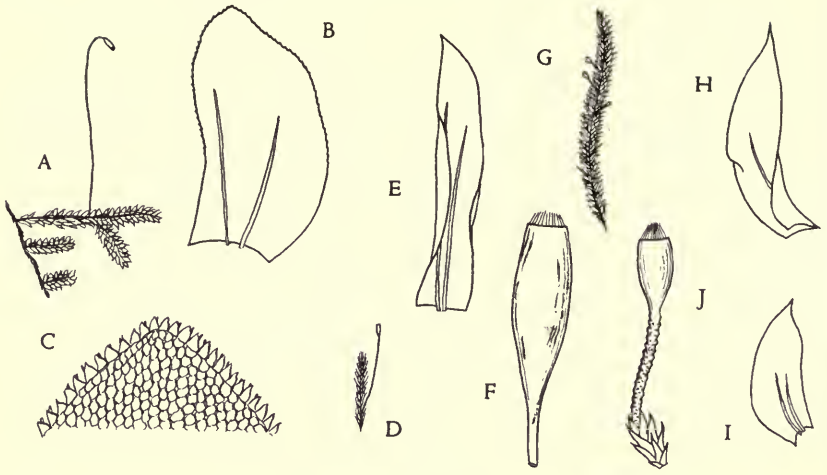

FIGURE 137

A–C, *Hookeriopsis incurva:* A, plant, ×1; B, leaf, ×14; C, leaf apex, ×53.
D–F, *Actinodontium Standleyi:* D, plant, ×1; E, leaf, ×14; F, capsule, ×10.
G–J, *Lepidopilum brevipes:* G, plant, ×1; H and I, lateral leaves, ×10; J, sporophyte, ×8.

Autoicous; robust plants, dull green tinged with red, in extensive mats. Stems 2–6 cm. long, freely branched, 3–5 mm. wide. Lateral leaves widely spreading, slightly shrivelled when dry, not undulate, 2–2.5 mm. long, oblong-obovate, obtuse, sharply serrate above middle with paired teeth; costae ending about ⅔ up, toothed on back above; cells oval-hexagonal, smooth, about 30 μ wide, more elongate below. Seta 2–2.5 cm. long; capsule horizontal, ovoid-cylindric, urn 2 mm. long. (Fig. 137, A–C.)

Dept. Alta Verapaz: *Steyermark 44790; Turckheim 6911.*

Distribution: Costa Rica, West Indies, South America.

On log at low altitude. The obovate, obtuse, laxly areolate leaves, serrate with paired teeth, sharply distinguish this species from any of its associates.

EXCLUDED SPECIES

HOOKERIA LEVIERI Broth., Bull. Herb. Boiss. **5**: 206. 1897.

No material is available and the species is omitted by Brotherus in the "Pflanzenfamilien."

8. ACTINODONTIUM Schwaegr., Suppl. 2, **2**[1]: 75. 1826.

Heteroicous; plants gregarious or in small tufts; stems ascending, densely foliate on all sides. Leaves lanceolate, acuminate, subentire; costa double to beyond mid-leaf; cells elongate, smooth. Seta elongate, smooth; capsules erect; lid long beaked; peristome teeth papillose with a zig-zag median line, bordered by the wider dorsal plates, segments of endostome narrow from a low basal membrane; calyptra naked, laciniate at base.

1. ACTINODONTIUM STANDLEYI Bartr., Bryol. **49**: 119. 1946.

Dioicous; small yellowish green plants; stems about 1 cm. high, radiculose at base. Leaves uniform, crowded, erect when dry, 2–2.5 mm. long, 0.5 mm. wide, oblong-lanceolate, short acuminate, entire; costae extending about ¾ up, smooth on back; margins narrowly revolute; cells narrowly rhomboidal, 15 μ wide, 90 μ long, smooth, shorter and lax at extreme base. Seta slender, smooth, 1 cm. long; capsule erect, cylindric, urn 2 mm. long; lid conic-rostrate; calyptra laciniate at base. (Fig. 137, D–F.)

Dept. Suchitepequez: Near Pueblo Nuevo, alt. about 750 m., *Standley 66941* (in part).

Endemic.

Wet thicket; on Guadna sheaths. The leaves are appreciably broader and more shortly pointed than in *A. Sprucei*, which has been collected in Costa Rica. The distinction is slight but uniform in the limited material available for comparison.

9. LEPIDOPILUM Brid., Bryol. Univ. **2**: 267. 1827.

Slender to robust, often glossy plants growing in lax tufts. Primary stems creeping, secondary stems suberect, usually complanate-foliate, simple or sparingly branched. Dorsal and ventral rows of leaves erect; lateral rows larger, spreading, asymmetrical, acuminate, serrate above; costa double, ending near mid-leaf or shorter; cells smooth, narrowly hexagonal, often linear toward margins, forming an indistinct border, more elongate below. Setae to 1 cm. or more long, mostly papillose or densely setose; capsules erect; peristome teeth with a fine, zig-zag median line, usually bordered by the broader dorsal plates, segments narrow from a low basal membrane; lid conical; calyptra naked or ramentose.

1. Leaves distinctly bordered with 3 or more rows of narrow cells.....2
   Leaf border none or of 1 row of narrow cells.....5
2. Synoicous, stems attenuate at tips, leaves 6–7 mm. long...8. *L. polytrichoides*
   Dioicous, stems blunt, leaves shorter.....3
3. Leaf cells very lax, to 125 μ long.....7. *L. diaphanum*
   Leaf cells firm, less than 60 μ long.....4
4. Leaves abruptly short acuminate, upper cells rounded, nearly isodiametrical
   10. *L. subtortifolium*
   Leaves acute, upper cells oval-hexagonal.....9. *L. tortifolium*
5. Setae short, about 2 mm. long.....1. *L. brevipes*
   Setae 5 mm. or more long.....6
6. Setae densely prickly, leaf cells long and narrow.....7
   Setae papillose, leaf cells rhomboidal.....8
7. Setae 9–10 mm. long, autoicous.....2. *L. haplociliatum*
   Setae 5–6 mm. long, dioicous.....4. *L. radicale*
8. Setae smooth below.....3. *L. cubense*
   Setae scabrous to base.....9
9. Costa ending near mid-leaf.....5. *L. Mohrianum*
   Costa shorter, ending ¼ up leaf.....6. *L. subenerve*

1. LEPIDOPILUM BREVIPES Mitt., Journ. Linn. Soc. **12**: 376. 1869.

Lepidopilum Decaisnei Besch., Prodr. Bryol. Mex. 84. 1871.

Autoicous; slender plants; stems to 3–4 cm. long, 3–4 mm. wide. Lateral leaves 2.5–3 mm. long, ovate-lanceolate, acuminate, serrulate above; costae slender, ending near mid-leaf; cells linear-rhomboidal. Seta 2–3 mm. long, coarsely papillose throughout; capsule ovoid, erect, urn 1 mm. long; calyptra small, sparingly ramentose. (Fig. 137, G–J.)

Dept. Alta Verapaz: *Steyermark 44734*. Dept. San Marcos: *Standley 68533a, 68649a*. Dept. Quezaltenango: *Steyermark 33441a, 33442a*. Dept. Sacatepequez: *Standley 66872a, 66914*.

Distribution: Mexico, Costa Rica, Panama, Peru.

On trees and rocks at low to moderately high altitudes. If there are any distinctions between *L. brevipes* and *L. Decaisnei* I fail to find them. Nos. 33441a, 33442a, 44734 and 68649a in the above series may be referable to the var. *brevicuspis* Card. (Rev. Bryol. **38**: 41. 1911) but the differences are not impressive.

2. LEPIDOPILUM HAPLOCILIATUM (C. M.) Par., Ind. Bryol. Suppl. 223. 1900.

Hookeria haplociliata C. M., Bull. Herb. Boiss. **5**: 206. 1897.

Autoicous; pale green, glossy plants; stems to 3–4 cm. long, complanate-foliate, 6 mm. wide. Lateral leaves 3–3.5 mm. long, narrowly oblong-lanceolate, long acuminate, serrulate toward apex; costae slender, ending near mid-leaf; cells linear. Setae slender, 8–9 mm. long, densely hispid, papillose at extreme base; capsule inclined, ovoid-cylindric, urn 1.5–2 mm. long; peristome 1 mm. long; calyptra sparsely ramentose. (Fig. 138, A–C.)

Dept. Alta Verapaz: *Standley 70490a, 90773b, 90815a, 91485.* Dept. San Marcos: *Standley 86548b.*

Distribution: Costa Rica.

On trees at moderate altitudes. I have not seen the types of either *L. haplociliatum* or *L. Mulleri* (Hampe) Mitt. and therefore hesitate to make the reduction but strongly suspect that they are one and the same species.

3. LEPIDOPILUM CUBENSE (Sull.) Mitt., Journ. Linn. Soc. **12**: 384. 1869.

Hookeria cubensis Sull., Proc. Am. Acad. **1861**: 285. 1861.

Dioicous? plants yellowish green, densely gregarious; stems about 2 cm. high, complanate-foliate, 4 mm. wide. Lateral leaves slightly shrivelled when dry, 2.5 mm. long, oblong-ovate, abruptly sharp

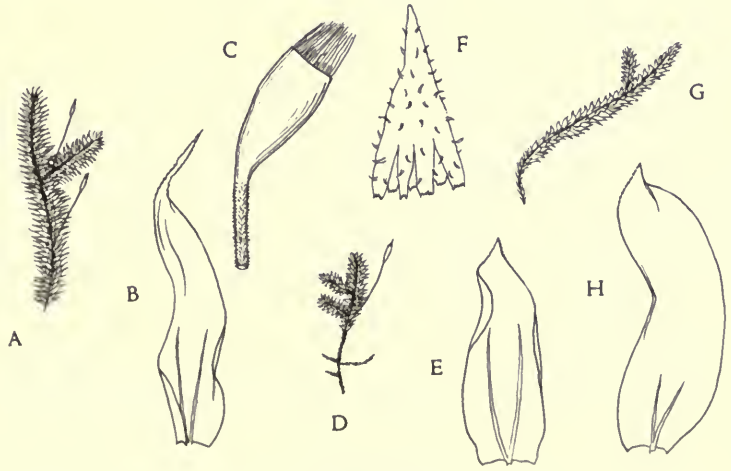

FIGURE 138

A–C, *Lepidopilum haplociliatum:* A, plant, ×1; B, leaf, ×14; C, capsule, ×8.
D–F, *Lepidopilum cubense:* D, plant, ×1; E, leaf, ×14; F, calyptra, ×8.
G–H, *Lepidopilum radicale:* G, plant, ×1; H, leaf, ×14.

acuminate, serrulate above; costae ending about ¾ up; cells oval-hexagonal, linear in one row at margins, more elongate below. Seta 8–9 mm. long, scabrous above, smooth below; capsule erect, ovoid-cylindric, urn 2–2.5 mm. long; calyptra 3 mm. long, extending half way down urn, ramentose. (Fig. 138, D–F.)

Dept. Sacatepequez: *Standley 58125.*

Distribution: Costa Rica, Cuba.

On tree trunk at medium altitude. Until the tropical American species of Lepidopilum are resolved it is hopeless to indicate the synonymy and distribution of this complex group.

4. LEPIDOPILUM RADICALE Mitt., Journ. Linn. Soc. **12:** 378. 1869.

Dioicous; stems to 4 cm. or more long, 4 mm. wide. Lateral leaves 3 mm. long, oblong-ovate, short acuminate, serrulate above; costa short and inconspicuous, ending below mid-leaf; cells linear. Seta 5–6 mm. long, hispid throughout; capsule inclined, oblong-cylindric, urn 1.5 mm. long; calyptra sparingly ramentose. (Fig. 138, G–H.)

Dept. Quezaltenango: *Steyermark 33881?*

Distribution: Guadeloupe, Martinique, South America.

On moist rocks at moderate altitude. A sterile collection and hence open to question. The leaf characters correspond well with the type collection.

5. LEPIDOPILUM MOHRIANUM C. M., Linnaea **38:** 649. 1874.

Autoicous; stems 1–2 cm. long, 3 mm. wide. Lateral leaves 1.5 mm. long, ovate-lanceolate, acute or short acuminate, serrulate; costae slender, ending near mid-leaf; cells oval-hexagonal, one row at margins linear, more elongate below. Seta 8 mm. long, densely hispid above, coarsely papillose near base; capsule inclined, oblong, urn 1.5 mm. long. (Fig. 139, A–C.)

Dept. Sacatepequez: *Standley 88961* (as *L. amplirete*).

Distribution: Mexico.

On tree at moderate altitude. Determined from description; type not seen.

6. LEPIDOPILUM SUBENERVE Brid., Bryol. Univ. **2:** 268. 1827.

Autoicous; stems 1–2 cm. long, branched, 3 mm. wide. Lateral leaves 1.5 mm. long, oblong-lanceolate, short acuminate, asym-

metrical, serrulate above; costae slender and short, seldom extending more than ¼ up leaf; cells narrowly hexagonal, more elongate below. Seta 6–9 mm. long, coarsely hispid throughout; capsule inclined, oblong; calyptra ramentose. (Fig. 139, D–F.)

Dept. Alta Verapaz: *Steyermark 44420.*

Distribution: Costa Rica, West Indies, South America.

On log at low altitude. The asymmetrical, short pointed leaves with short costae and the strongly scabrous, short setae seem to be distinctive but the group needs clarifying.

7. LEPIDOPILUM DIAPHANUM (Hedw.) Mitt., Journ. Linn. Soc. **12**: 382. 1869.

Hypnum diaphanum Hedw., Sp. Musc. 243. 1801.

Dioicous; plants pale green with an iridescent sheen; secondary stems to 4 cm. long, simple or branched, 4–5 mm. wide. Leaves thin and delicate, lateral rows widely spreading, asymmetrical, 2.5 mm. long, 1.25 mm. wide, broadly ovate, entire, rapidly contracted to a subulate-acuminate point, median rows shorter; costae slender, ending near mid-leaf or often nearly lacking; cells large, lax,

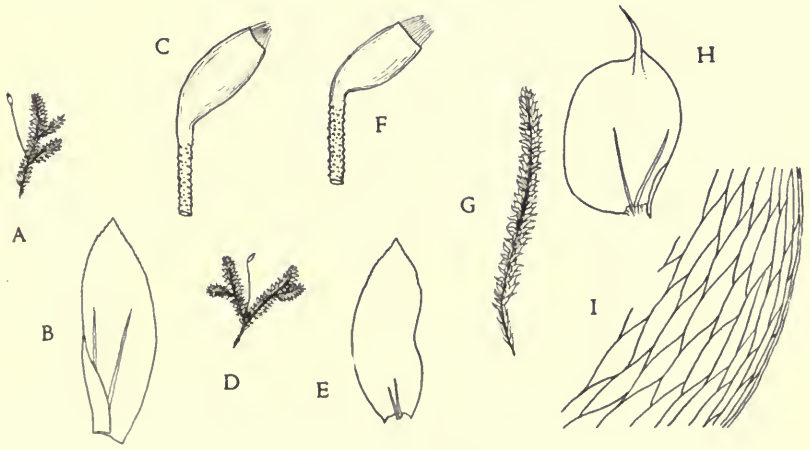

FIGURE 139

A–C, *Lepidopilum Mohrianum:* A, plant, ×1; B, lateral leaf, ×14; C, capsule, ×8.

D–F, *Lepidopilum subenerve:* D, plant, ×1; E, lateral leaf, ×14; F, capsule, ×8.

G–I, *Lepidopilum diaphanum:* G, plant, ×1; H, lateral leaf, ×10; I, upper leaf cells and margin, ×120.

hexagonal-rhomboidal, to 120 μ long, 30–40 μ wide, narrower toward margins in 3–4 rows forming an indistinct border. (Fig. 139, G–I.)

Dept. Zacapa: *Steyermark 42374* (as *L. vesicularioides*).

Distribution: Jamaica.

By dripping rock slide at moderate altitude. This is a noteworthy collection and a rather startling addition to the Guatemalan flora. Apparently the species has never been recollected since the original gathering by Swartz. Comparisons with a few fragments of the type in the New York Botanical Garden show a complete agreement.

8. LEPIDOPILUM POLYTRICHOIDES (Hedw.) Brid., Bryol. Univ. **2**: 269. 1827.

Hypnum polytrichoides Hedw., Sp. Musc. 244. 1801.

?Hookeria Carionis C. M., Bull. Herb. Boiss. **5**: 205. 1897.

Usually synoicous; robust plants, secondary stems to 8 cm. high, simple or sparingly branched, 10–12 mm. wide, attenuate at tips. Leaves contorted when dry, lateral rows widely spreading, 5–6 mm. long, 2 mm. wide, oblong-ovate, abruptly subulate-acuminate, serrate in upper half; costae strong, ending above mid-leaf; cells narrowly rhomboidal, linear in 3–5 rows at margins; median leaves smaller, ovate. Seta 3 mm. long, coarsely papillose; capsule erect, urn 1.5 mm. long; calyptra ramentose. (Fig. 140, A–D.)

Dept. Izabal: *Steyermark 39067, 41736; Standley 72902.* Dept. Alta Verapaz: *Steyermark 44984, 45548a.* Dept. Huehuetenango: *Steyermark 49368.*

Distribution: Mexico, West Indies, Central and South America.

On trees at low altitudes. Widely distributed and frequently fruiting. Probably the commonest species of the genus in the American tropics.

9. LEPIDOPILUM TORTIFOLIUM Mitt., Journ. Linn. Soc. **12**: 374. 1869.

Dioicous; stems slender, to 4 cm. long, simple or forked, 3 mm. wide with leaves. Leaves strongly contorted when dry, lateral rows erect-spreading, 1.5–2 mm. long, oblong, acute, serrulate near apex, broadly bordered; costae strong, ending about ¾ up; cells oval-hexagonal, 25–30 μ wide, averaging 1:2, linear in 3–6 rows at margins forming a rather distinct border; median leaves shorter, broadly ovate. Seta slender, 10 mm. long, sharply papillose throughout;

capsule inclined, ovoid-cylindric, urn 1.5 mm. long; calyptra sparingly ramentose. (Fig. 140, E–H.)

Dept. Izabal: *Steyermark 38819, 41866.*

Distribution: Costa Rica, South America.

On damp banks at low altitudes. The sporophyte characters are described from a Costa Rican collection.

10. LEPIDOPILUM SUBTORTIFOLIUM Bartr., Bryol. **49**: 119. 1946.

Rather robust plants, pale green; stems complanate-foliate, sparingly branched, about 5 mm. wide with leaves. Leaves subappressed and strongly contorted when dry, widely spreading when moist, oblong, short acuminate, 2–2.5 mm. long, 1 mm. wide, broadly bordered with 6–7 rows of long, narrow cells; costae stout, extending nearly to base of acumen, often ending in and confluent with the border on one side; upper leaf cells hexagonal, nearly isodiametrical, diameter 12–20 μ, basal cells laxer, rectangular, thin walled. Fruit unknown. (Fig. 141, A–C.)

Dept. San Marcos: Along road between San Sebastian at km. 21 and km. 8, 8–18 miles northwest of San Marcos, alt. 2,700–3,800 m., *Steyermark 35714* TYPE; also *36928.*

Endemic.

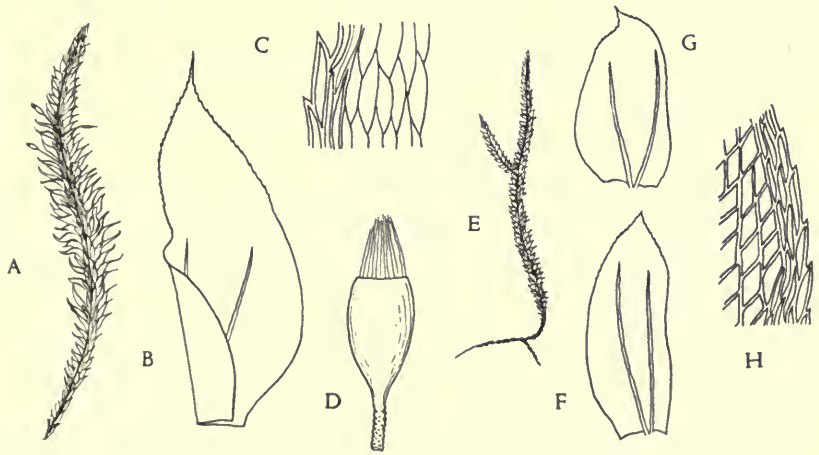

FIGURE 140

A–D, *Lepidopilum polytrichoides:* A, plant, ×1; B, lateral leaf, ×10; C, upper leaf cells and margin, ×133; D, capsule, ×8.

E–H, *Lepidopilum tortifolium:* E, plant, ×1; F, lateral leaf, ×14; G, median leaf, ×14; H, upper leaf cells and margin, ×108.

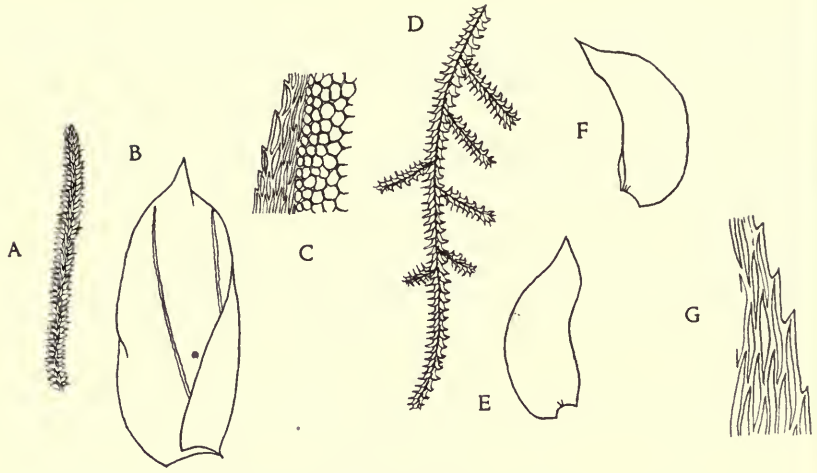

FIGURE 141

A–C, *Lepidopilum subtortifolium:* A, plant, ×1; B, lateral leaf, ×14; C, upper leaf cells and margin, ×108.

D–G, *Isodrepanium lentulum:* D, part of plant, ×1; E and F, leaves, ×12; G, upper leaf cells and margin, ×267.

Moist slopes below overhanging ledge at base of waterfall. Although near *L. tortifolium* Mitt. this species may be distinguished by the shorter upper leaf cells and longer costae.

10. ISODREPANIUM (Mitt.) E. G. Britt., Torreya **14**: 28. 1914.

Lepidopilum sec. *Isodrepanium* Mitt., Journ. Linn. Soc. **12**: 366. 1869.

Dioicous; plants robust, golden green, glossy; secondary stems elongate, pendent, pinnate or bipinnate, complanate-foliate. Leaves cultriform, short pointed, serrulate; costa lacking or very short and double; cells linear.

1. ISODREPANIUM LENTULUM (Wils.) E. G. Britt., Torreya **14**: 28. 1914.

Homalia lentula Wils., Ann. Mag. Nat. Hist. **20**: 397. 1847.

Neckera falcifolia Ren. & Card., Bull. Soc. Roy. Bot. Belg. **32**: 184. 1893.

Secondary stems to 20 cm. or more long, often shorter, irregularly pinnate to regularly bipinnate. Leaves crowded, appearing distichous, widely spreading with decurved apices, about 2 mm. long,

oblong, abruptly short acuminate, very asymmetrical, serrulate above middle; costa usually very short and double, often lacking; cells narrowly linear, scarcely 3 μ wide. Very rarely fruiting; sporophyte not seen. (Fig. 141, D–G.)

Dept. Izabal: *Steyermark 41935a.* Dept. Alta Verapaz: *Steyermark 44462; Standley 91675a.* Dept. Huehuetenango: *Steyermark 48859, 48866b.* Dept. Zacapa: *Steyermark 29853.*

Distribution: Costa Rica, West Indies, South America.

On trees at moderate altitudes. The peculiarly shaped leaves are characteristic. The apex is curved or bent above the middle so that the apical part of the leaf often stands nearly at a right angle to the base.

11. CROSSOMITRIUM C. M., Linnaea **38**: 611. 1874.

Dioicous; plants golden green or brown, glossy; stems creeping, very complanate-foliate, sparingly branched. Leaves in 4 rows, median rows obliquely erect, lateral rows larger, spreading, broadly ovate, short pointed, ecostate, serrulate, teeth often bifid; cells elongate, smooth. Seta short, papillose; capsules erect; peristome teeth papillose, with a fine zig-zag median line, segments narrow, keeled, from a low basal membrane; calyptra naked, fringed at base.

1. Lateral leaves suborbicular, not shrivelled when dry.....3. *C. Oerstedianum*
   Lateral leaves oblong, shrivelled when dry.....2
2. Seta 8–9 mm. long, smooth below, scabrous above.....1. *C. patrisiae*
   Seta 5 mm. long, scabrous throughout.....2. *C. scabrisetum*

1. CROSSOMITRIUM PATRISIAE (Brid.) C. M., Linnaea **38**: 612. 1874.

Hypnum Patrisiae Brid., Bryol. Univ. **2**: 539. 1827.

Stems to 3–4 cm. long, very flat, 3–3.5 mm. wide, radiculose in tufts on lower side. Leaves slightly contorted when dry, lateral rows widely spreading, 2 mm. long, oblong-ovate from a narrow, rounded base, abruptly short acuminate, carinate at apex, serrulate above with the teeth often minutely bifid at tips; cells linear. Seta 8–9 mm long, scabrous above, smooth below; capsule oblong-cylindric, inclined, urn 1.5 mm. long; lid subulate-rostrate, 1.5 mm. long; calyptra 1.5 mm. long, fringed at base with long, articulated hairs. (Fig. 142, A–D.)

Dept. Peten: *Lundell 2499, 2707* (both as *C. Herminieri*). Dept. Izabal: *Standley 72881.* Dept. Alta Verapaz: *Standley 70967* (as *C. orbiculatum*), *90773a* (as *C. orbiculatum*).

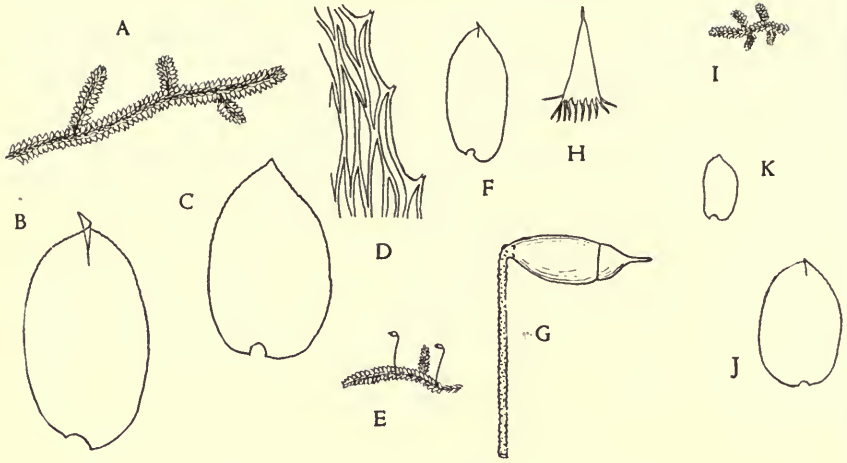

FIGURE 142

A–D, *Crossomitrium patrisiae:* A, plant, ×1; B, lateral leaf, ×14; C, median leaf, ×14; D, upper leaf cells and margin, ×267.

E–H, *Crossomitrium scabrisetum:* E, plant, ×1; F, lateral leaf, ×14; G, capsule, ×12; H, calyptra, ×12.

I–K, *Crossomitrium Oerstedianum:* I, plant, ×1; J, lateral leaf, ×14; K, median leaf, ×14.

Distribution: Costa Rica, Panama, West Indies, South America.

On leaves and bark in wet forests at low to moderate altitudes. There are too many poorly defined species in this group. Until a revisional study is made it seems wiser to include the local collections cited above in *C. patrisiae.*

2. CROSSOMITRIUM SCABRISETUM Bartr., Bryol. **49**: 119. 1946.

Slender, glossy, yellowish green epiphyllous plants; stems creeping, sparingly branched, complanate-foliate, with scattered tufts of radicles on under side. Leaves much shrivelled when dry, the lateral rows divergent, oblong-lanceolate, keeled at apex, acuminate, ecostate; margins denticulate nearly to base, the teeth often characteristically bifid; cells linear, smooth, laxly rhomboidal at extreme base. Seta 5 mm. long, pale yellow, densely and coarsely tuberculose to the base; capsule horizontal, oblong, urn 1 mm. long, tuberculose at base; lid conic-rostrate, less than half the length of the urn; calyptra short, barely covering the lid, fringed at base with long, articulated hairs. (Fig. 142, E–H.)

Dept. Izabal: Damp, forested slopes and barrancos, alt. 300–900 m., *Steyermark 41879,* TYPE.

Endemic.

There is nothing noteworthy in the vegetative characters of this species but the sporophyte seems to be sharply distinct in the shorter, highly tuberculose setae and the tuberculose base of the capsule.

3. CROSSOMITRIUM OERSTEDIANUM C. M., Flora **1875**: 545. 1875.

Plants pale green; stems 1–2 cm. long, 2–3 mm. wide. Leaves crowded, not contorted when dry, lateral rows spreading, 1–1.5 mm. long, orbicular-ovate, slightly carinate at apex, abruptly contracted to a very short, often oblique, obtuse point, minutely serrulate above; cells linear, more lax near insertion. Sporophyte not seen. (Fig. 142, I–K.)

Dept. Alta Verapaz: *Standley 70953a* (as *C. orbiculatum*).

Distribution: Costa Rica.

On tree at moderate altitude. I have not seen the type of *C. Oerstedianum* but the above number agrees with the description and with a Costa Rican collection.

12. RHYNCHOSTEGIOPSIS C. M., Nuov. Giorn. Bot. Ital. **4**: 163. 1897.

Rather robust, glossy plants in dense mats; stems elongate, creeping, irregularly branched or subpinnate. Leaves uniform, complanate, acuminate, falcate-secund, ecostate, coarsely serrate toward apex; cells linear, smooth, shorter across insertion. Seta elongate, smooth; capsules horizontal, ovoid-cylindric with a tapering neck, contracted under mouth; peristome teeth with a median furrow, segments from a high basal membrane; lid slenderly beaked; calyptra cucullate, naked.

1. RHYNCHOSTEGIOPSIS FLEXUOSA (Sull.) C. M., Nuov. Giorn. Bot. Ital. **4**: 163. 1897.

Hypnum flexuosum Sull., Proc. Am. Acad. **1861**: 288. 1861.
Rhynchostegium cupressinum Besch., Prodr. Bryol. Mex. 106. 1871.
Vesicularia auricolor C. M., Bull. Herb. Boiss. **5**: 211. 1897.

Dioicous; plants pale green or golden green; stems 2–3 cm. long, mostly irregularly branched but sometimes pinnate, complanate-foliate, hooked at tips. Leaves crowded, spreading with decurved points, 1.5–2 mm. long, ovate-lanceolate, gradually long acuminate,

coarsely and sharply serrate above middle; cells linear, pellucid. Seta slender, to 3 cm. long; capsule subhorizontal, urn 1–1.5 mm. long; lid subulate from a conical base; calyptra 2 mm. long, naked, split on one side about half way up, minutely lobed at base. (Fig. 143, A–D.)

Dept. Izabal: *Steyermark 41919*. Dept. Alta Verapaz: *Standley 70410a, 91963*. Dept. Huehuetenango: *Steyermark 48886*. Dept. San Marcos: *Standley 86406*. Dept. Quezaltenango: *Standley 67444, 67450, 67878, 85021, 85022, 85024, 85557, 85926, 85983, 85994; Steyermark 33645, 33646, 34090, 34324*. Dept. Suchitepequez: *Steyermark 46711*. Dept. Chimaltenango: *Standley 61818*. Dept. Guatemala: *Standley 80525*. Dept. Zacapa: *Steyermark 42557, 42656, 42661, 43226*. Dept. Chiquimula: *Steyermark 31009*.

Distribution: Mexico, Honduras, Costa Rica, Cuba, Jamaica.

On logs, trees, damp banks, rocks, etc., generally distributed but mostly at rather high altitudes. The slender, pale forms grade imperceptibly into the more robust, golden green plants described as *V. auricolor* but in the absence of any structural differences I have little doubt but that they are all variants of one specific type.

13. PHILOPHYLLUM C. M., Bull. Herb. Boiss. **6**: 123. 1898.

Synoicous; very soft, delicate, yellowish green plants, slightly glossy. Stems elongate, subpinnately branched. Leaves crowded, laxly spreading, with long, fine, undulate or crispate tips when dry, unbordered, entire, ecostate; cells linear, smooth. Seta slender, smooth; capsules inclined; peristome teeth with a median furrow, segments from a high basal membrane; lid conic-rostrate; calyptra mitriform, naked, lobed at base.

1. PHILOPHYLLUM TENUIFOLIUM (Mitt.) Broth., E. & P. Pflanzenf. 1^3: 945. 1907.

Hookeria tenuifolia Mitt., Journ. Linn. Soc. **12**: 359. 1869.

Stems to 6 or 8 cm. long, 2–3 mm. wide. Leaves uniform, 3–4 mm. long, ovate-lanceolate, gradually narrowed to a long, piliform, flexuous point, entire, ecostate; cells linear, delicate, more lax at base. Seta 1–2 cm. long; capsule cylindrical, curved and contracted under mouth when dry, urn 1.5 mm. long. (Fig. 143, E–H.)

Dept. Alta Verapaz: *Steyermark 43890*.

Distribution: Brazil.

Floating in water at base of bromeliad leaves. An exceedingly interesting discovery as the genus is known only from Brazil. The

Guatemalan plants differ in no appreciable way from *P. tenuifolium* and have the same peculiar texture and habit.

14. HARPOPHYLLUM Spruce, Catal. 1867.

Autoicous; robust, laxly tufted plants. Primary stems creeping, branches ascending, irregularly pinnate. Leaves crowded, erect-spreading on all sides, often secund, lanceolate, strongly plicate; costa double, ending in acumen; cells linear. Seta elongate, smooth; capsules subhorizontal; peristome teeth with a median furrow, segments keeled, from a high basal membrane; lid slenderly beaked; calyptra lobed at base, naked or sparingly ramentose above.

1. HARPOPHYLLUM AUREUM (P. Beauv.) Spruce, Catal. 1867.

Mnium aureum P. Beauv., Prodr. 74. 1805.

?Hemiragis Friedrichsthaliana Reich'd., Bull. Herb. Boiss. 5: 208. 1897.

Plants bright yellowish green, glossy. Branches 2–6 cm. high, densely foliate. Leaves 3–4 mm. long, oblong-lanceolate from a broad base, gradually subulate-acuminate, serrulate all around, deeply plicate; costae extending well into acumen, weakly toothed on back above, ending in a dorsal spine; cells linear, shorter and

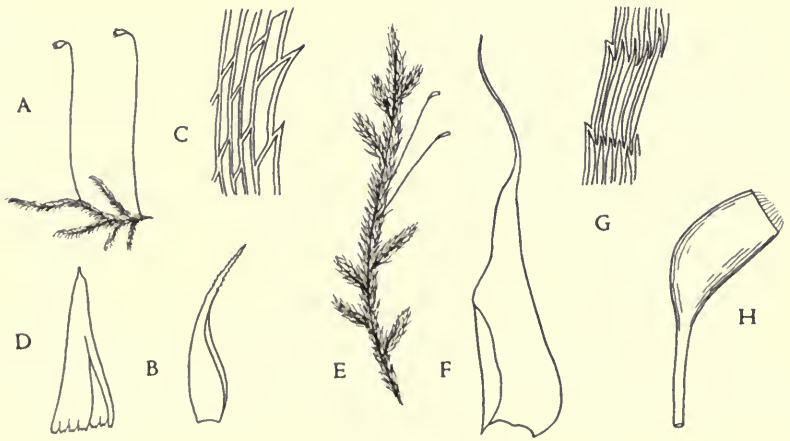

FIGURE 143

A–D, *Rhynchostegiopsis flexuosa:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×107; D, calyptra, ×10.

E–H, *Philophyllum tenuifolium:* E, plant, ×1; F, leaf, ×14; G, upper leaf cells and margin, ×107; H, capsule, ×8.

brown across insertion. Seta 2–4 cm. long; capsule oblong, wide mouthed, urn 2 mm. long; calyptra long beaked. (Fig. 144, A–B.)

Distribution: Costa Rica, West Indies, South America.

On trees and logs. Evidently rare and localized in Guatemala. I have seen no local collections but the species is credited to our area. It is a conspicuous moss and one that would scarcely be overlooked even by a random collector.

37. LEUCOMIACEAE

Slender, delicate, pale green plants growing in thin mats. Stems prostrate, flattened, irregularly branched. Leaves acuminate, entire, ecostate; cells large, lax, smooth. Seta slender, slightly scabrous above; capsules horizontal; lid slenderly beaked; peristome double, teeth with a median furrow; calyptra cucullate, naked or sparingly pilose.

1. LEUCOMIUM Mitt., Journ. Linn. Soc. **1868**: 25. 1868.

We have but one genus with the characters of the family.

Leaves narrowly lanceolate, gradually acuminate, shrunken and contorted when dry ..... 1. *L. lignicola*

Leaves broadly ovate-lanceolate, abruptly acuminate, not shrunken when dry ..... 2. *L. latifolium*

1. LEUCOMIUM LIGNICOLA Spruce, Journ. Linn. Soc. **12**: 503. 1869.

Stems 1–2 cm. long, 3 mm. wide. Leaves crowded, flexuous-spreading, slightly secund, shrunken when dry, ovate-lanceolate, gradually subulate or filiform-acuminate; cells elongate, lax and thin walled, 25–30 μ wide, 4 to 6 times as long. Seta 1 cm. long, curved at tip; capsule oblong; lid subulate-rostrate, as long as urn; calyptra sparingly pilose. (Fig. 144, C–E.)

Dept. Izabal: *Steyermark 39766*.

Distribution: Costa Rica, South America.

On log at low altitude. This collection is representative of a group that needs to be clarified. There are too many closely allied species without any tangible or apparent distinctions.

2. LEUCOMIUM LATIFOLIUM Bartr., Bryol. **49**: 120. 1946.

Autoicous; rather robust, flaccid, pale green glossy plants in lax, flat mats. Stems prostrate, sparingly branched, complanate-foliate,

3.5 mm. wide with leaves. Lateral leaves spreading, 2 mm. long, scarcely 1 mm. wide, oblong-ovate, abruptly narrowed to a slender, hair-like point, lightly concave, ecostate; margins erect, entire, acumen only minutely denticulate; cells very lax, long hexagonal, thin walled, about 175 μ long, 36 μ wide. Seta about 15 mm. long, reddish, smooth; capsule horizontal, elliptical, urn 1.5 mm. long; lid conic-rostrate, 1 mm. long. (Fig. 144, F–H.)

Dept. Alta Verapaz: Cerro Chinaja, between Finca Yalpemech and Chinaja, above source of Rio San Diego, alt. 150–700 m., *Steyermark 45668* TYPE.

Endemic.

On bark of tree. Distinct from all the other North American species in the broadly ovate, abruptly acuminate leaves not shrivelled when dry. *L. Moseni* Broth. of Brazil is apparently a similar plant but the leaves are described as short acuminate and the setae 11 mm. long.

38. HYPOPTERYGIACEAE

Gregarious plants with creeping primary stems and erect, usually frondose secondary stems freely branched from a simple, stipe-like base. Leaves dimorphous; lateral rows complanate, ovate, acute,

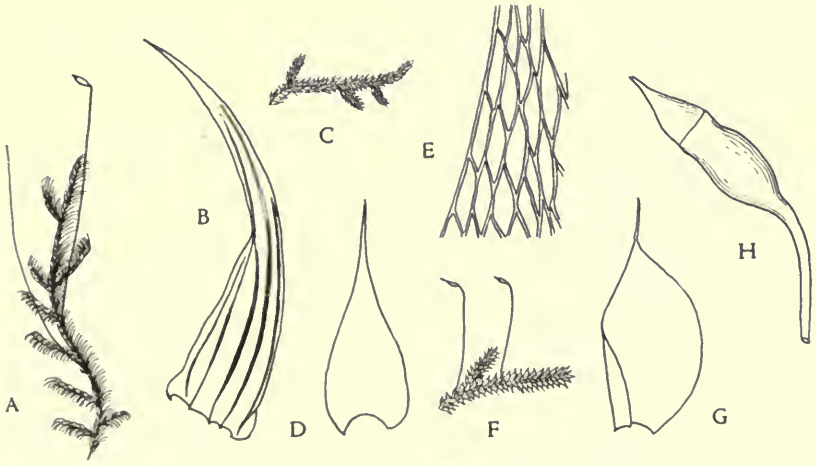

FIGURE 144

A–B, *Harpophyllum aureum:* A, part of plant, ×1; B, leaf, ×16.

C–E, *Leucomium lignicola:* C, plant, ×1; D, lateral leaf, ×14; E, upper leaf cells and margin, ×107.

F–H, *Leucomium latifolium:* F, plant, ×1; G, lateral leaf, ×14; H, capsule, ×10.

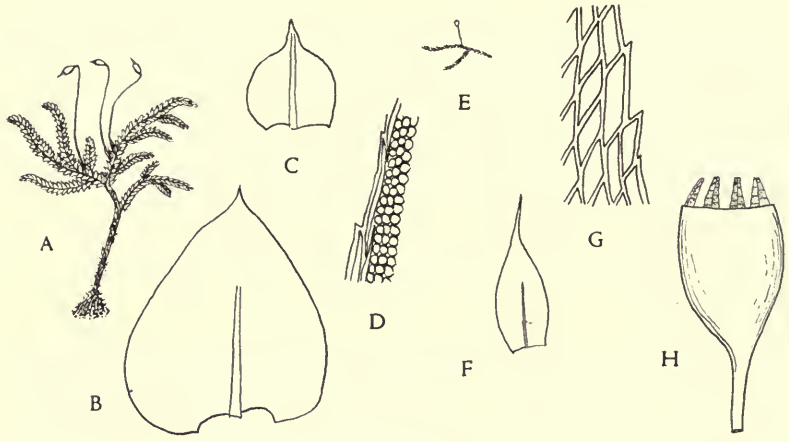

FIGURE 145

A–D, *Hypopterygium tamariscinum:* A, plant, ×1; B, lateral branch leaf, ×14; C, ventral branch leaf, ×14; D, upper leaf cells and margin, ×107.

E–H, *Fabronia Wrightii:* E, plant, ×1; F, leaf, ×24; G, upper leaf cells and margin, ×267; H, capsule, ×34.

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asymmetrical; ventral row (amphigastria) much smaller, acuminate. Seta elongate; capsules pendulous; peristome double; lid long beaked; calyptra conical, naked, split on one side.

1. HYPOPTERYGIUM Brid., Bryol. Univ. **2**: 709. 1827.

Plants with the characters of the family.

1. HYPOPTERYGIUM TAMARISCINUM (Hedw.) Brid., Bryol. Univ. **2**: 715. 1827.

Leskea tamariscina Hedw., Sp. Musc. 212. 1801.

Hypopterygium pseudotamarisci C. M., Linnaea **38**: 645. 1874.

Secondary stems about 3 cm. high, densely branched above in a broad frond, tomentose toward base of stipe and often nearly to frond. Stipe leaves broadly ovate from a cordate base, acuminate; branch leaves about 2 mm. long, ovate, narrowly bordered with 2–3 rows of elongated cells, sharply serrate toward apex; costa ending about ¾ up; cells oval-hexagonal, smooth. Amphigastria much smaller, ovate, abruptly subulate-acuminate; costa ending in acumen. Seta 1.5 cm. long, reddish; capsule horizontal to pendulous, urn ovoid, 2 mm. long, slenderly beaked from a conical base; calyptra 3 mm. long. (Fig. 145, A–D.)

Dept. Alta Verapaz: *Standley 71217, 71218.* Dept. San Marcos: *Steyermark 37111.* Dept. Quezaltenango: *Steyermark 33731.* Dept. Zacapa: *Steyermark 29926, 30030, 30053, 42615.*

Distribution: Florida, Mexico, West Indies, Central and South America.

On trees and damp rocks at moderate altitudes. As far as I can see *H. pseudotamarisci* cannot be segregated by any stable characters.

39. FABRONIACEAE

Slender, delicate plants growing in thin mats on the bark of trees and on rocks. Stems creeping, irregularly branched, branches often ascending. Leaves ovate, acuminate; costa single, slender, ending in blade; cells rhomboidal, smooth, quadrate toward basal angles. Seta slender; capsules exserted, erect; peristome single or double; lid conic-apiculate; calyptra cucullate, mostly naked.

1. Peristome single....2
   Peristome double....3
2. Peristome teeth present, endostome lacking....1. *Fabronia*
   Peristome teeth lacking, segments of endostome well developed....2. *Fabronidium*
3. Peristome teeth transversely striolate....3. *Helicodontium*
   Peristome teeth papillose....4
4. Lid rostrate....4. *Schwetschkea*
   Lid conical, blunt....5. *Pseudodimerodontium*

1. FABRONIA Raddi, Atti Acad. Sci. Siena **9**: 230. 1808.

Very small, delicate, almost microscopic plants growing in thin mats. Stems creeping, freely branched. Leaves minute, spreading on all sides, ovate-lanceolate, acuminate, toothed above; costa slender; cells rhomboidal, quadrate in several rows at basal angles. Seta short; capsules erect; peristome single, teeth in 8 pairs; lid conical.

Leaves strongly ciliate-dentate....1. *F. ciliaris*
Leaves evenly serrulate....2. *F. Wrightii*

1. FABRONIA CILIARIS (Brid.) Brid., Bryol. Univ. **2**: 171. 1827.

Hypnum ciliare Brid., Musc. Recent. Suppl. 2: 155. 1812.

Autoicous; very slender, delicate, yellowish green plants in intricate thin mats, on bark of trees. Stems creeping, freely branched. Leaves minute, laxly appressed when dry, more spreading when

moist, ovate-lanceolate, long acuminate, about 0.5 mm. long; margins ciliate-dentate in upper two-thirds with widely spreading, unicellular teeth to 35 μ long; costa faint, ending below mid-leaf; upper cells narrowly rhomboidal, subquadrate at basal angles. Seta 2–3 mm. long, pale; capsule erect, wide-mouthed, ovoid; peristome teeth paired, brown, papillose. (Fig. 146, A–B.)

Dept. Quezaltenango: *Sharp 1953, 2302, 2305, 2331.*

Distribution: Northern United States south to Arizona and New Mexico, South Atlantic states, Mexico.

On bark of oaks at moderately high altitudes. It is not surprising that this species should turn up in Guatemala, considering its wide distribution in southern United States and Mexico. *Fabronia* is so inconspicuous that it is not likely to be collected by anyone but an experienced bryologist.

2. FABRONIA WRIGHTII Sull., Mosses of U. S. 61. 1856, also Icones Musc. 133, pl. 84. 1864.

Fabronia flavinervis C. M., Linnaea **38**: 645. 1874.

Fabronia Turckheimii C. M., Bull. Herb. Boiss. **5**: 202. 1897.

Autoicous; plants pale or yellowish green in thin, silky patches. Branches to 5 mm. long. Leaves erect-spreading, 0.7–0.9 mm. long, ovate-lanceolate, slenderly acuminate, serrulate above middle; costa ending about mid-leaf; cells narrowly rhomboidal, 10–12 μ wide, about 3–5:1, quadrate at basal angles in 3–5 rows, often extending nearly to costa. Seta 2–3 mm. long; capsule ovoid, urn 0.5 mm. long; peristome teeth 125 μ high, brown, vertically papillose-striolate; spores 10–15 μ. (Fig. 145, E–H.)

Dept. Huehuetenango: *Standley 82773* in part. Dept. Santa Rosa: *Standley 78101a.*

Distribution: Texas, Arizona, Mexico and probably wider.

On bark of trees at moderate altitudes. Any clear conception of the species and ranges involved in tropical America will have to be preceded by a radical revision of the group. There are no perceptible distinctions between the plants of Texas and Arizona and those of Mexico and Guatemala.

2. FABRONIDIUM C. M., Hedwigia **38**: 132. 1899.

Autoicous; slender plants; stems irregularly branched, branches short, spreading. Leaves ovate-lanceolate, minutely serrulate above;

costa single; cells as in *Fabronia*. Seta short; capsule erect; outer peristome lacking, segments of endostome papillose, from a low basal membrane, with numerous openings along the median line.

1. FABRONIDIUM BERNOULLIANUM C. M., Hedwigia **38**: 132. 1899.

Plants apparently resembling *Fabronia* in appearance and habit but distinct in the peristome structure as described above. Lid and calyptra unknown.

No part of the type collection is available. The above description is a condensed compilation from the original and from the Pflanzenfamilien. It is evidently very local, as nothing approaching the description was found in any of Standley's, Steyermark's or Sharp's gatherings.

3. HELICODONTIUM Schwaegr., Suppl. 3^2: 2. 1824.

Autoicous; slender, dull brownish green plants, yellowish at tips, in thin, intricate mats. Stems elongate, creeping, freely branched. Leaves appressed when dry, erect-spreading when moist, ovate, gradually pointed; margins plane, minutely toothed above; costa ending above mid-leaf; cells oval-rhomboidal, quadrate at basal angles. Seta short, erect, slightly scabrous; capsules erect, ovoid, contracted below mouth; peristome double, teeth transversely striolate, segments of endostome keeled, from a low basal membrane; lid obliquely conic-rostrate.

1. HELICODONTIUM CAPILLARE (Hedw.) Jaeg., Adumb. **2**: 291. 1875–76.

Leskea capillare Hedw., Sp. Musc. 221. 1801.

Stems to 2 cm. long, subpinnately branched, branches widely spreading, to 4 or 5 mm. long, somewhat julaceous when dry. Leaves small, spreading on all sides, less than 1 mm. long, ovate, gradually narrowed to a subacute point; margins minutely toothed above by projecting cell ends; costa ending about ⅔ up; cells oval-rhomboidal with firm, pale walls, slightly elongate near costa at extreme base, quadrate in 4–6 rows at basal angles. Seta 5–6 mm. long, reddish, slightly scabrous; capsule erect, oblong-ovoid, urn to 1.5 mm. long; peristome teeth pale, finely transversely striolate, segments of endostome as long or longer than teeth, from a low basal membrane, narrowly fenestrate along keel; lid 0.6 mm. long, obliquely rostrate

from a conical base; spores minutely papillose, diameter 15–20 μ. (Fig. 146, C–E.)

Dept. Quezaltenango: *Sharp 2085*. Dept. Baja Verapaz: *Sharp 2927, 2928, 2896*.

Distribution: Mexico, Nicaragua, West Indies, South America.

On trees at moderate altitudes. The occurrence of this species in Guatemala is not unexpected as it is well known in Mexico and has been collected in Nicaragua. Apparently it is more frequent through the West Indies than on the mainland.

4. SCHWETSCHKEA C. M., Linnaea **39**: 429. 1875.

Autoicous; very slender plants in thin mats; stems creeping, subpinnately branched. Leaves erect, often slightly secund, ovate-lanceolate; costa single; cells oval-hexagonal, quadrate at basal angles. Seta slender; capsules erect; peristome double, teeth papillose, segments narrow, about as long as teeth; lid short beaked from a convex base.

1. SCHWETSCHKEA GUATEMALENSIS C. M., Bull. Herb. Boiss. **5**: 202. 1897.

Stems creeping, branches very short and slender, remote, curved. Stem leaves crowded, ovate, from a narrow base, entire, long subulate-acuminate; costa slender, pale, ending near mid-leaf; upper cells prosenchymatous, quadrate at base. Seta short; capsule ovoid, erect, minute; peristome teeth short, narrowly lanceolate, brownish, segments of endostome short, capillary.

Mazatenango: *Bernoulli & Cario 85*.

I have not seen the type and know no more of this species than is represented by the above free translation of the original description.

5. PSEUDODIMERODONTIUM (Broth.) Broth., E. & P. Pflanzenf. **11**: 294. 1925.

Schwetschkea Sec. 2, *Pseudodimerodontium* Broth., E. & P. Pflanzenf. **1**[3]: 908. 1907.

Autoicous; very slender, glossy plants in intricate mats. Stems elongate, creeping, irregularly branched, branches julaceous when dry. Leaves small, ovate-lanceolate, acuminate, plane margined, entire; costa ending near base of acumen; cells narrowly oval, trans-

versely oval in numerous rows at basal leaf angles. Seta erect, smooth; capsules cylindrical; lid short, conical; peristome double, teeth papillose, segments of endostome from a low basal membrane.

1. PSEUDODIMERODONTIUM BOLIVIANUM (C. M.) Broth., E. & P. Pflanzenfam. **11**: 294. 1925.

Schwetschkea boliviana C. M., Nuov. Giorn. Bot. Ital. **4**: 81. 1897.

Plants densely matted, yellowish green above, light brown below. Stems to 2 cm. long, branches numerous, wiry, curved, julaceous and very slender when dry. Leaves squarrose-spreading on all sides when moist, to 0.6 mm. long, ovate-lanceolate from a cordate base, gradually acuminate; margins plane, entire; costa ending near base of acumen; upper cells narrowly oval to linear-rhomboidal, transversely oval in 8 or 10 rows at basal angles. Seta to 10 mm. long, reddish, smooth; capsule erect, cylindrical, urn to 2 mm. long, occasionally slightly curved; peristome double; teeth to 0.3 mm. long, densely papillose throughout, segments of endostome as long as teeth, papillose, fragile; lid short, blunt, conical; spores 15–20 μ in diameter. (Fig. 146, F–H.)

Dept. Quezaltenango: *Sharp 2304*.

Distribution: Bolivia.

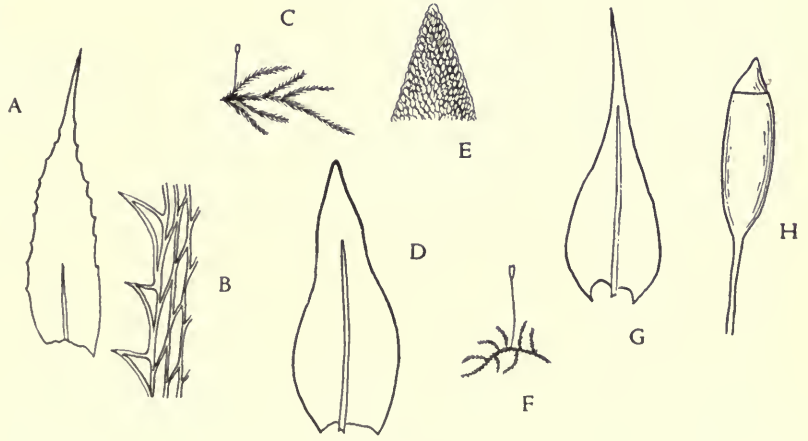

FIGURE 146

A–B, *Fabronia ciliaris:* A, leaf, ×80; B, upper leaf cells and margin, ×270. C–E, *Helicodontium capillare:* C, plant, ×1; D, leaf, ×54; E, apex of leaf, ×110. F–H, *Pseudodimerodontium bolivianum:* F, plant, ×1; G, leaf, ×68; H, capsule, ×8.

On trees at rather high altitude. A new genus to North America and a surprising leap in distribution. As the plants are well fruited the blunt, conical operculum is sharply diagnostic. I have followed Brotherus in segregating the genus from Schwetschkea but the distinction seems hardly of generic importance. The Bolivian plants are described as having setae up to 7 mm. long. Here they measure up to 10 mm. but otherwise the agreement is complete.

40. LESKEACEAE

Plants slender to medium sized, growing in mats or tufts. Stems creeping, branches erect or ascending. Stem and branch leaves often differentiated, paraphyllia usually present. Leaves crowded, lusterless, ovate; costa strong, usually ending below apex; cells short, generally strongly papillose. Seta elongate; capsules erect or subhorizontal; peristome double, endostome occasionally imperfect; lid conic-rostrate; calyptra cucullate, usually naked.

1. Peristome teeth much shorter than segments of endostome....1. *Rhegmatodon*
   Peristome teeth and segments about equal in length.....2
2. Leaf cells smooth, costa sinuous above.....4. *Herpetineurum*
   Leaf cells papillose, costa straight.....3
3. Capsules erect, paraphyllia few or none.....4
   Capsules subhorizontal, paraphyllia numerous.....5
4. Leaf cells densely papillose, endostome with segments.....3. *Anomodon*
   Leaf cells faintly papillose, endostome without segments.....2. *Lindbergia*
5. Apical cell of branch leaves bearing 2 or more papillae.....7. *Thuidium*
   Apical cell of branch leaves with a single, sharp papilla.....6
6. Leaves dimorphous, stem leaves slenderly acuminate.....5. *Haplocladium*
   Leaves not differentiated, stem leaves short acuminate.....6. *Rauia*

1. RHEGMATODON Brid., Bryol. Univ. **2**: 204. 1827.

Autoicous; slender plants in dense, dull, yellowish green mats. Stems creeping, much branched, branches ascending, rigid, julaceous. Leaves erect, imbricated when dry, ovate, acute, entire; margins plane; costa ending about ⅔ up leaf; cells oval-rhomboidal, incrassate, smooth. Seta short, stout, smooth; capsules erect, cylindrical; peristome double, teeth short, blunt, segments of endostome much longer than teeth, from a low basal membrane; lid bluntly conical.

1. RHEGMATODON FILIFORMIS Schimp., in Besch. Prod. Bryol. Mex. 87. 1871.

Stems densely branched, rigid, branches to 1 cm. long. Leaves appressed when dry, spreading on all sides when moist, ovate, sharply acute, entire; costa ending above mid-leaf; cells oval-rhomboidal, with pale, incrassate walls, irregularly subquadrate in several rows at basal margins. Seta red, 7–8 mm. long; capsule erect, cylindrical, slightly asymmetrical, urn 3 mm. long; peristome teeth inserted below rim, smooth, projecting 150 μ above rim, segments of endostome about three times as long as teeth, from a low basal membrane, papillose; lid bluntly conical, 1 mm. long; spores coarsely papillose, diameter 24–28 μ. (Fig. 148, D–G.)

Dept. Quezaltenango: *Sharp 2063, 2086.* Dept. Chimaltenango: *Sharp 2571.*

Distribution: Mexico.

On oaks at moderately high altitudes. So many of the Mexican types range into Guatemala that these collections merely emphasize the close relation between the two floras that naturally are not limited by any artificial boundaries.

2. LINDBERGIA Kindb., Eur. & N. A. Bryin. **1**: 13. 1897.

Small laxly tufted plants; stems elongate, irregularly branched. Leaves crowded, imbricated when dry, spreading when moist; costa

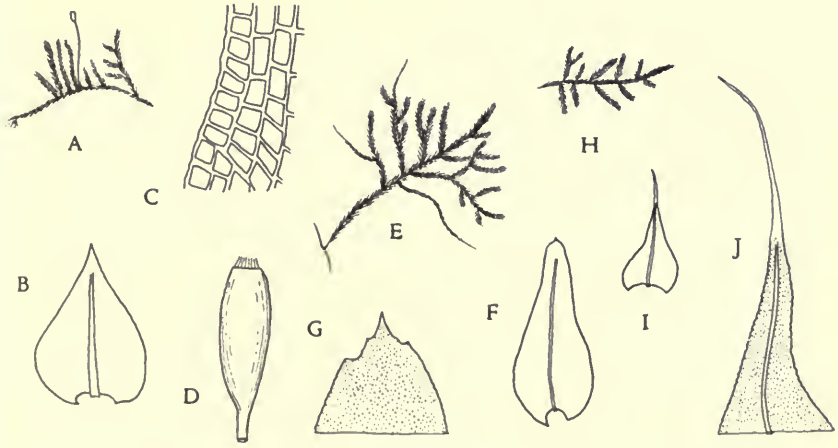

FIGURE 147

A–D, *Lindbergia mexicana:* A, plant, ×1; B, leaf, ×28; C, upper leaf cells and margin, ×270; D, capsule, ×8.
E–G, *Anomodon attenuatus:* E, plant, ×1; F, leaf, ×14; G, apex of leaf, ×110.
H–J, *Anomodon rostratus:* H, plant, ×1; I, leaf, ×14; J, apex of leaf, ×68.

strong, ending below apex; cells rounded, papillose. Seta elongate; capsules erect; inner peristome rudimentary, without segments or lacking.

1. LINDBERGIA MEXICANA (Besch.) Card., Rev. Bryol. **37**: 52. 1910.
Leskea mexicana Besch., Prodr. Bryol. Mex. 89. 1871.
Haplohymenium densum Schimp., Prodr. Bryol. Mex. 89. 1871.

Autoicous; stems 2–3 cm. long, branches numerous, slender, erect or curved, subjulaceous when dry. Leaves ovate-lanceolate, 0.7–0.8 mm. long, short acuminate, entire; costa strong, ending below apex; cells irregularly oval-rhomboidal, incrassate, faintly papillose, transversely elongate in oblique rows toward base. Seta 8–10 mm. long; capsule oblong-ovoid, urn 1.5–2 mm. long; peristome teeth 180 μ long, blunt, papillose, inner peristome reduced to a narrow, yellowish membrane; spores 20–24 μ. (Fig. 147, A–D.)

Dept. Alta Verapaz: *Standley 92051* in part. Dept. Quezaltenango: *Standley 84368*.

Distribution: Texas, New Mexico, Mexico.

Mostly on bark of trees at moderate altitudes. The Guatemalan specimens are fragmentary but surely belong here. The plants vary considerably within reasonable limits but are clearly distinct from *L. Austinii* Sull. in the shorter leaf points and nearly smooth leaf cells.

3. ANOMODON Hook. & Tayl., Musc. Brit. Ed. 1, 79. 1818.

Dioicous; plants dull green or yellowish green growing in dense mats; stems creeping, branches numerous, without paraphyllia. Leaves crowded, plane margined, entire; costa strong, ending near apex; cells rounded, densely papillose. Seta elongate, smooth; capsules erect; peristome double, segments short, from a low basal membrane; lid conical; calyptra small, cucullate.

1. Leaf apex broadly rounded ..... 1. *A. minor*
Leaf apex apiculate or hair-pointed 2
2. Stems slender, leaves hair-pointed ..... 3. *A. rostratus*
Stems coarse, leaves broadly acute or apiculate ..... 2. *A. attenuatus*

1. ANOMODON MINOR (Hedw.) Lindb. var. INAEQUALIFOLIUS Bartr., Bryol. **50**: 207. 1947.

In intricate, dull, dark green mats. Secondary stems freely and irregularly branched, often with slender, microphyllous, stoloniferous

shoots. Leaves appressed and contorted when dry, squarrose-spreading and complanate when moist, to 1.4 mm. long, lingulate from a broad, slightly decurrent base, broadly rounded at apex, inequilateral so that the upper side of the leaf is broader than the lower side where the margin is broadly incurved; costa ending far below apex; upper cells small, opaque, papillose, basal cells near costa 3 to 4 times as long as wide, quickly becoming smaller, rounded and obscure toward margins. (Fig. 148, A–C.)

Dept. Huehuetenango: *Sharp 4857.*

Endemic.

On limestone bluff at moderate altitude. These plants certainly fall within the concept of *A. minor* but with several rather striking differences. The leaves are more squarrose-spreading when moist and of a very different shape. Here they have broader, shorter points and are frequently very unequally divided by the costa so that the upper side of the leaf as it stands on the stem is wider than the lower half which instead of being straight has the edge curved inwardly.

2. ANOMODON ATTENUATUS (Hedw.) Hueben., Musc. Germ. 562. 1832.

Leskea attenuata Hedw., Sp. Musc. 230. 1801.

Rather coarse plants in extensive, lax mats; branches about 3 cm. long, freely rebranched, often flagelliform at tips. Leaves appressed

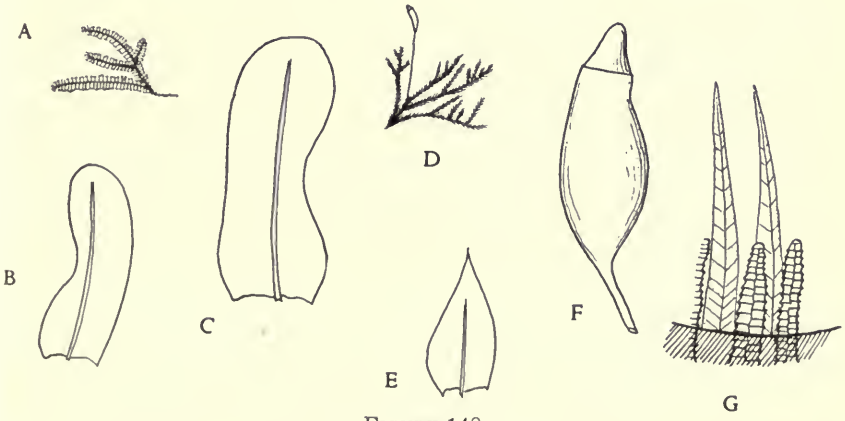

FIGURE 148

A–C, *Anomodon minor* var. *inaequalifolius:* A, plant, ×1; B, leaf, ×20; C, leaf, ×26.

D–G, *Rhegmatodon filiformis:* D, plant, ×1; E, leaf, ×20; F, capsule, ×8; G, part of peristome, ×100.

and slightly contorted when dry, 1–1.7 mm. long, lingulate from a broadly ovate base, acute or apiculate, toothed near apex; costa pellucid, ending near apex; cells obscure, densely papillose, small and rounded, elongate and pellucid near costa at base. Seta to 2 cm. long; capsule cylindric, urn 2–3 mm. long; lid beaked; segments of endostome filiform, nearly as long as teeth. (Fig. 147, E–G.)

Dept. Alta Verapaz: *Standley 92104*.

Distribution: Canada, United States, Mexico, Europe, Asia, Japan.

On tree at moderate altitude. This collection represents the southern limit of distribution in North America.

3. ANOMODON ROSTRATUS (Hedw.) Schimp., Syn. Ed. 1, 488. 1860.

Leskea rostrata Hedw., Sp. Musc. 226. 1801.

Slender, yellowish plants in extensive, dense mats; branches julaceous. Leaves closely imbricated, nearly 1 mm. long, narrowly lanceolate from an ovate base, crenulate-papillose, ending in a long, hyaline, entire hair-point; costa ending near apex; cells small, rounded, obscure, papillose, more elongated and pellucid near costa at base. Seta to 10 mm. long; capsule ovoid, urn to 2 mm. long. (Fig. 147, H–J.)

Dept. Alta Verapaz: *Standley 90129, 90130*.

Distribution: Northeastern United States west to Arizona, Mexico, Jamaica, Bermuda, Europe, Asia.

On limestone rocks at moderate altitudes. Not previously known from south of Mexico.

4. HERPETINEURUM (C. M.) Card., Beih. Bot. Centr. **19**[2]: 127. 1905.

Anomodon Sec. *Herpetineurum* C. M., Flora **73**: 495. 1890.

Rather robust plants, wiry when dry; branches often flagelliform, paraphyllia lacking. Leaves appressed when dry, serrate above; costa strong, flexuous; cells small, smooth. Sporophyte rare, similar to that of *Anomodon*.

1. HERPETINEURUM TOCCOAE (Sull. & Lesq.) Card., Beih. Bot. Centr. **19**[2]: 127. 1905.

Anomodon toccoae Sull. & Lesq., Musc. Bor. Am. Ed. 1, 240. 1856.

Plants dark green, laxly tufted, branches often curved at tips. Leaves ovate-lanceolate, to 2 mm. long, faintly plicate below, acuminate; margins plane, coarsely serrate above; costa prominently flexuous above, ending near apex; cells rounded, dense, incrassate, smooth. (Fig. 149, A–C.)

Dept. Huehuetenango: *Standley 81215*.

Distribution: Southeastern United States, South America, Asia, Africa, East Indies.

On damp bank at moderate altitude. Occurring sporadically in temperate and tropical regions but almost consistently sterile.

5. HAPLOCLADIUM (C. M.) C. M., Nuov. Giorn. Bot. Ital. **3**: 116. 1896.

Hypnum Sec. *Haplocladium* C. M., Linnaea **42**: 459. 1878–79.

Slender, dull yellowish green plants in thin mats; stems creeping, subpinnately branched, paraphyllia various. Stem leaves ovate-lanceolate, long acuminate; costa nearly percurrent; branch leaves smaller, shorter pointed; cells unipapillate. Seta elongate; capsules inclined or pendulous; peristome double, complete; lid conic-apiculate.

1. HAPLOCLADIUM MICROPHYLLUM (Hedw.) Broth., E. & P. Pflanzenf. 1^3: 1007. 1907.

Hypnum microphyllum Hedw., Sp. Musc. 269. 1801.

Autoicous; stems 2–4 cm. long, pinnate. Stem leaves to 1.25 mm. long, ovate-lanceolate, slenderly acuminate, serrulate nearly all around; costa ending in acumen; cells hexagonal, unipapillate, more elongate near apex and at base. Branch leaves smaller, less finely acuminate. Perichaetium conspicuous, to 2.5 mm. long; seta to 2.5 cm. long; capsule oblong-cylindric, curved, urn 1.5–2 mm. long, pale brown, contracted under mouth when dry. (Fig. 149, D–G.)

Dept. Peten: *Bartlett 12616* in part. Dept. Huehuetenango: *Standley 82999a* (as *Rauia subcatenulata*). Dept. Sacatepequez: *Standley 62198* (as *Rauia subcatenulata*). Dept. Guatemala: *Standley 63017* (as *Rauia subcatenulata*). Dept. Jalapa: *Standley 76684* (as *Rauia subcatenulata*), *77078* (as *Rauia subcatenulata*).

Distribution: Southern Canada, United States, Mexico, West Indies, Europe, Asia.

On dead wood, banks and trees at low to medium altitudes. Frequent and variable but usually well defined from *Rauia subcatenulata* by the slenderly acuminate stem leaves.

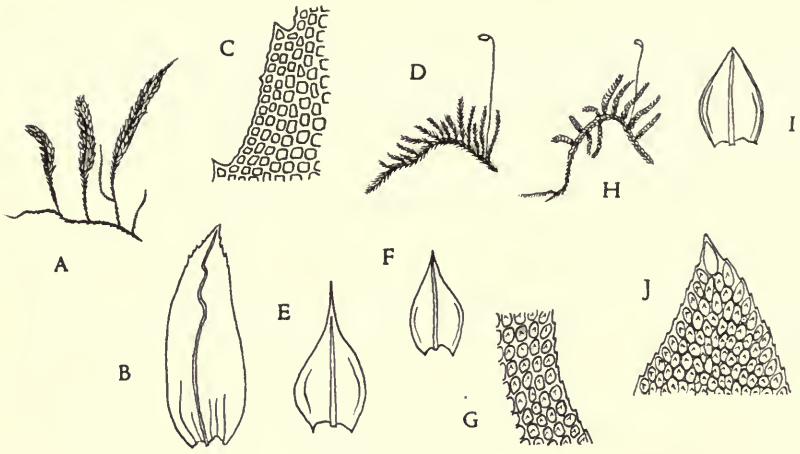

FIGURE 149

A–C, *Herpetineurum toccoae:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×270.

D–G, *Haplocladium microphyllum:* D, plant, ×1; E, stem leaf, ×14; F, branch leaf, ×14; G, upper leaf cells and margin, ×270.

H–J, *Rauia subcatenulata:* H, plant, ×1; I, branch leaf, ×14; J, apex of branch leaf, ×270.

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6. RAUIA Austin, Bull. Torr. Bot. Club 7: 16. 1880.

Slender, rigid, green or brownish plants; stems irregularly pinnate, branches julaceous with abundant paraphyllia. Stem and branch leaves not differentiated. Leaves closely imbricated when dry, ovate, short acuminate; costa strong, ending below apex; cells small, rounded, papillose. Seta elongate; capsules curved, horizontal; peristome double, complete; lid conic-apiculate.

1. RAUIA SUBCATENULATA (Schimp.) Broth., E. & P. Pflanzenf. 1[3]: 1005. 1907.

Pseudoleskea subcatenulata Schimp., Prodr. Bryol. Mex. 90. 1871.

Autoicous; stems 2–3 cm. long, branches numerous, suberect, often curved. Leaves crowded, 0.8–1 mm. long, broadly ovate, short acuminate; margins recurved, papillose-crenulate; costa strong, ending near apex; cells small, dense, rounded, papillose. Perichaetium pale, inner leaves 3 mm. long, filiform-acuminate; seta 12 mm. long; capsule oblong-cylindric, curved, contracted under mouth when dry. (Fig. 149, H–J.)

Dept. Huehuetenango: *Standley 82298.* Dept. Sacatepequez: *Standley 58651.* Dept. Santa Rosa: *Standley 77924, 78137.*

Distribution: Mexico, Costa Rica.

On trees, banks and rocks at moderate altitudes. I doubt if *Thuidium leskaefolium* Ren. & Card. of Costa Rica can be satisfactorily separated from *Rauia subcatenulata*.

7. THUIDIUM Bry. Eur. fasc. 49–51. 1852.

Slender to robust, usually wiry plants growing in mats; stems prostrate or ascending, pinnate to tri-pinnate, paraphyllia usually abundant. Stem and branch leaves differentiated. Stem leaves ovate, acuminate, plicate; branch leaves smaller, ovate, concave, short pointed, apical cell with 2–4 papillae; costa strong; cells papillose. Seta elongate; capsules nodding or horizontal, arcuate; peristome double, complete; lid beaked.

1. Paraphyllia abundant, compound, stems robust, bi- or tri-pinnate.....2
   Paraphyllia few, simple, stems slender, pinnate or bi-pinnate.....3
2. Stem leaves with capillary hair-points 4–8 cells long.....5. *T. Philberti*
   Stem leaves acuminate, not capillary pointed.....4. *T. delicatulum*
3. Seta scabrous throughout.....3. *T. involvens*
   Seta smooth.....4
4. Branch leaves incurved-catenulate when dry.....1. *T. furfurosum*
   Branch leaves imbricated, not incurved-catenulate.....2. *T. Turckheimii*

1. THUIDIUM FURFUROSUM (H. f. & W.) Jaeg., Adumb. **2**: 332. 1876–77.

Hypnum furfurosum H. f. & W., Fl. N. Z. **2**: 107. 1855.

Dioicous; plants dull yellowish green, closely matted; stems 1–2 cm. long, bi-pinnately branched, paraphyllia short, slender and sparse. Stem leaves ovate-lanceolate from a broad, cordate base, abruptly subulate-acuminate, about 0.8 mm. long; margins recurved to above mid-leaf; costa smooth on back, ending near base of acumen, cells small, rounded, sharply papillate. Branch leaves smaller, strongly catenulate-incurved when dry, ovate, acute; costa slender, pellucid, ending well below apex; cells rather obscure, papillose. Perichaetial leaves long subulate-acuminate, sparsely ciliate on margins; seta 12–15 mm. long, red, smooth; capsule inclined, cylindrical, urn 2 mm. long; lid conic-rostrate, 1 mm. long. (Fig. 150, A–E.)

Dept. Quezaltenango: *Steyermark 34629*. Dept. Sacatepequez: *Standley 63315*. Dept. Solola: *Steyermark 47254*. Dept. Chimaltenango: *Standley 80253*. Dept. Guatemala: *Standley 80658*.

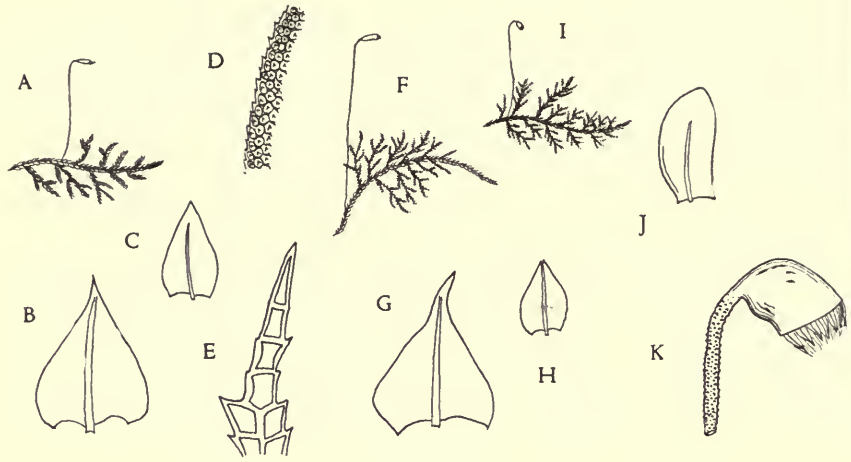

FIGURE 150

A–E, *Thuidium furfurosum:* A, plant, ×1; B, stem leaf, ×26; C, branch leaf, ×26; D, upper leaf cells and margin, ×270; E, paraphyllium, ×270.

F–H, *Thuidium Turckheimii:* F, plant, ×1; G, stem leaf, ×26; H, branch leaf, ×26.

I–K, *Thuidium involvens:* I, plant, ×1; J, branch leaf, ×44; K, capsule, ×12.

Distribution: Costa Rica, South America, Australia, New Zealand, Tasmania.

On tree trunks, banks and logs, mostly at rather high altitudes. Well distinguished by the arched branch leaves with incurved points when dry. A number of questionable species have been described from South America but it seems probable that a careful study will prove that they are all forms of one variable species widely distributed in the southern hemisphere and extending north to Central America.

2. THUIDIUM TURCKHEIMII C. M., Bull. Herb. Boiss. **5**: 219. 1897.

Autoicous; slender, yellowish green plants; stems laxly bi-pinnate, to 3 cm. long, paraphyllia few and simple. Stem leaves 0.6–0.7 mm. long, triangular-ovate, acuminate; costa ending in acumen; margins irregularly recurved, papillose-crenulate. Branch leaves ovate, concave, short acuminate, about 0.3 mm. long; costa prominent at back and often ending in a minute dorsal spine; cells small, dense, papillose. Perichaetial leaves subulate-acuminate, entire, not ciliate; seta 2–2.5 cm. long; capsule horizontal, urn oblong-cylindrical, 2 mm. long; lid conic-rostrate. (Fig. 150, F–H.)

Dept. San Marcos: *Steyermark 36477* in part. Dept. Quezaltenango: *Steyermark 35168; Standley 65396.* Dept. Chimaltenango: *Standley 61913a, 61923a, 61932.*

Distribution: Mexico.

On trees at rather high altitudes. The differences between this species and *T. minutulum* (Hedw.) Bry. Eur. seem to be slight, and I should not be surprised if they were eventually combined.

3. THUIDIUM INVOLVENS (Hedw.) Mitt., Journ. Linn. Soc. **12**: 575. 1869.

Leskea involvens Hedw., Sp. Musc. 218. 1801.

?Thuidium byssoideum C. M., Bull. Herb. Boiss. **5**: 219. 1897.

?Thuidium guatemalense Par., Ind. Bryol. 1282. 1898.

Autoicous; slender, dull green plants in thin mats; stems 2–3 cm. long, pinnate or bi-pinnate, paraphyllia few. Stem leaves distant, 0.3–0.4 mm. long, deltoid, ovate-acuminate. Branch leaves laxly imbricated, incurved when dry, about 0.4 mm. long, smaller on ultimate branches, ovate, bluntly pointed, concave; costa ending below apex; cells with several small papillae. Perichaetial leaves filiform-acuminate, not ciliate; seta 10–15 mm. long, scabrous throughout; capsule cernuous, ovoid, urn 1–2 mm. long. (Fig. 150, I–K.)

Dept. Peten: *Bartlett 12251, 12255, 12259, 12260, 12597; Lundell 2590.* Dept. Alta Verapaz: *Steyermark 44295.* Dept. Retalhuleu: *Standley 88496.*

Distribution: Florida, West Indies, Central and South America.

On logs and bases of trees at low altitudes. Freely fruiting and readily known by the minute leaves and papillose setae.

As none of the Guatemalan plants that I have examined show the perichaetial leaves ciliate on the margins, I have referred them all here in a broad sense pending a more critical study of the tropical American forms. I have been unable to segregate with any satisfaction the plants with simply pinnate stems from those with bi-pinnate branching.

4. THUIDIUM DELICATULUM (Hedw.) Mitt., Journ. Linn. Soc. **12**: 578. 1869.

Hypnum delicatulum Hedw., Sp. Musc. 260. 1801.

?Tamariscella ventrifolia C. M., Bull. Herb. Boiss. **5**: 220. 1897.

Dioicous; plants usually robust, growing in intricate mats, bright or yellowish green at tips, often tinged with brown. Stems to 10 cm.

long, wiry, often arched, bi- and tri-pinnate, paraphyllia multiform, abundant. Stem leaves appressed when dry, triangular-ovate from a subcordate base, sulcate, acuminate, 1–1.5 mm. long; costa ending in acumen; margins irregularly recurved; cells short oblong, papillate. Branch leaves smaller, ovate, concave, short acuminate; cells with short, forwardly curved papillae over lumens. Inner perichaetial leaves filiform-acuminate, margins usually long and copiously ciliate; seta 2–3 cm. long, reddish, smooth; capsule arcuate, cylindric, urn to 3.5 mm. long; lid long rostrate, 2 mm. long. (Fig. 151, A–D.)

Dept. Izabal: *Steyermark 41622.* Dept. Alta Verapaz: *Standley 69535, 70374, 70497, 71089, 71398, 71679, 71688, 71705, 89707, 89718, 89883, 90351, 90359, 90478, 90602, 90666, 90720, 91454, 91501, 91816, 92000, 92393, 92421, 92486, 92535, 92741, 92746; Steyermark 44764.* Dept. Huehuetenango: *Standley 65642, 81165, 81879, 81925, 82664, 82682; Steyermark 48473a, 48488, 49051, 50190.* Dept. San Marcos: *Steyermark 35606, 37462a; Standley 68907, 86457.* Dept. Totonicapan: *Standley 62665, 62668, 62711, 65886, 84010a, 84118, 84457, 84540.* Dept. Quezaltenango: *Standley 65312, 66296, 66814, 67227, 67503, 67633, 67664, 67828, 68174, 84265, 84588, 84603, 84685, 84749, 84764, 84783, 85230, 85460, 85607, 85683* in part, *85640, 85891, 86586, 86759, 86800, 87943; Steyermark 33210a, 33370a, 33374, 33375a, 33440, 34103, 34724, 34820, 34938.* Dept. Retalhuleu: *Standley 87209.* Dept. Sacatepequez: *Standley 65189, 65265.* Dept. Solola: *Steyermark 47466, 47569, 47944.* Dept. Chimaltenango: *Standley 57820, 58767, 58802a, 61109b, 61513, 61975, 64417, 80922.* Dept. Guatemala: *Standley 58421, 63027, 80570a, 80588, 80634, 80666, 80722.* Dept. El Progresso: *Steyermark 43452.* Dept. Zacapa: *Steyermark 29826, 30013a, 30032, 30028, 30039, 42641, 42671, 43205, 42799.* Dept. Chiquimula: *Steyermark 31013.* Dept. Jalapa: *Steyermark 32462, 32822; Standley 77498.* Dept. Santa Rosa: *Standley 69744.*

Distribution: Canada, United States, Mexico, West Indies, Central and South America.

On damp banks, trees, logs and rocks from near sea level to high altitudes. Decidedly the most frequent and broadly distributed moss in Guatemala. A very plastic, adaptable species with innumerable forms influenced by growing conditions. I hesitate to reduce the Mexican species of this affinity including *T. Schlumbergeri* Schimp.; *T. robustum* Card.; *T. subrobustum* Card. and probably *T. miradoricum* Jaeg. without more careful study. For it is quite unlikely that the distribution of any species as common and widely distributed in eastern and southern United States as *T. delicatulum* is limited by arbitrary political boundaries. *T. ventrifolium* (C. M.) is described as having the perichaetial leaves without cilia. I have seen no plants that could be definitely referred to this species.

5. Thuidium Philberti Limpr., Laubm. **2**: 835. 1895.

Distinguished from *T. delicatulum* by the stem leaves ending in a capillary point composed of a single row of 3–6 or 8 linear, hyaline

cells. Perichaetial leaves long loriform acuminate, serrulate, not ciliate. (Fig. 151, E–F.)

Dept. Totonicapan: *Standley 62696*.

Distribution: New Jersey, Pennsylvania, New Mexico, Europe, Asia.

On tree at high altitude. In this collection undeveloped perichaetia show the characters described above and the stem leaves are capillary pointed. As far as the material goes it seems to be clearly referable to *T. Philberti*.

EXCLUDED SPECIES

THUIDIUM SIPHOTHECA (C. M.) Jaeg., Adumb. **2**: 321. 1876–77.

Hypnum siphotheca C. M., Bot. Zeit. **1858**: 171. 1858.

No authentic material of this species is available.

41. AMBLYSTEGIACEAE

Very slender to moderately robust plants, often glossy. Stems irregularly branched or pinnate, paraphyllia rarely present. Leaves symmetrical; costa usually single; cells smooth, thin walled, alar

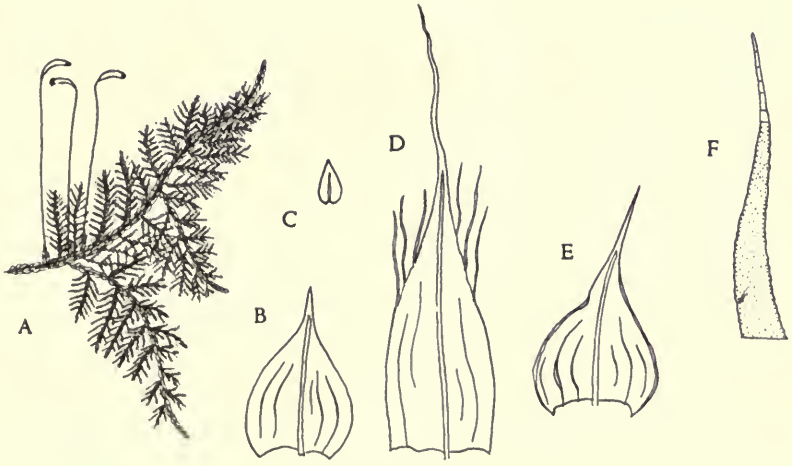

FIGURE 151

A–D, *Thuidium delicatulum:* A, plant, ×1; B, stem leaf, ×14; C, ultimate branch leaf, ×14; D, perichaetial leaf, ×14.

E–F, *Thuidium Philberti:* E, stem leaf, ×14; F, apex of stem leaf, ×54.

cells often well differentiated. Seta elongate, smooth; capsules usually cernuous, often curved; peristome complete; lid conical; calyptra cucullate, naked.

1. Stems with abundant paraphyllia ..... 1. *Cratoneuron*
   Paraphyllia scarce or none 2
2. Leaves falcate-secund 3
   Leaves erect-spreading 4
3. Leaves short-pointed, costa variable, ending near mid-leaf .... 6. *Hygrohypnum*
   Leaves slenderly acuminate, costa single, ending in acumen .. 7. *Drepanocladus*
4. Leaves widely spreading ..... 2. *Campylium*
   Leaves erect-spreading 5
5. Terrestrial plants, on various substrata ..... 5. *Amblystegium*
   Aquatic plants 6
6. Costa stout, percurrent ..... 4. *Hygroamblystegium*
   Costa slender, ending far below apex ..... 3. *Leptodictyum*

1. CRATONEURON (Sull.) Roth., Hedwigia 38: 6. 1899.

Hypnum subg. *Cratoneuron* Sull., Musc. & Hep. U. S. 73. 1856.

Dioicous; rather coarse plants, yellowish green, densely tufted; stems often suberect, regularly pinnate, paraphyllia multiform and numerous. Leaves decurrent, somewhat secund; stem leaves ovate, costa strong, cells smooth, inflated and auriculate at basal angles. Seta elongate; capsules cylindrical, arcuate; lid conic-apiculate; peristome complete.

1. CRATONEURON FILICINUM (Hedw.) Roth., Hedwigia 38: 6. 1899.

Hypnum filicinum Hedw., Sp. Musc. 286. 1801.

Stems rigid, suberect, to 5 cm. long or longer, closely pinnate, paraphyllia laciniate. Stem leaves erect-spreading, 1.5–2 mm. long, triangular-ovate from a cordate base, serrulate, acuminate; costa strong, percurrent; cells narrowly oblong, abruptly inflated and often colored toward basal angles forming decurrent auricles. Branch leaves narrower, falcate-secund. (Fig. 152, A–D.)

Dept. Huehuetenango: *Steyermark 50202.*

Distribution: Canada, United States, Europe, Africa, Asia, New Zealand.

On damp ground near spring at high altitude. Partial to calcareous regions and very variable. The above collection is quite typical and the first record for Central America.

2. CAMPYLIUM (Sull.) Mitt., Journ. Linn. Soc. **12**: 63. 1869.

Hypnum subg. *Campylium* Sull., Mosses U. S. 77. 1856.

Plants slender to medium sized, partial to damp habitats; stems creeping, irregularly branched. Leaves squarrose-spreading on all sides, acuminate; costa single or short and double; cells narrow, elongate, quadrate or enlarged at basal angles. Seta elongate; capsules curved, subhorizontal; peristome complete.

1. Leaves with a single costa.....3. *C. chrysophyllum*
   Leaves with costa short and double or lacking.....2
2. Slender plants, alar cells few, small and quadrate.....1. *C. hispidulum*
   More robust plants, alar cells enlarged.....2. *C. stellatum*

1. CAMPYLIUM HISPIDULUM (Brid.) Mitt. var. SOMMERFELTII (Myr.) Lindb., Contr. ad Fl. Crypt. As. Bor. 279. 1872.

Hypnum Sommerfeltii Myr., Vet. Akad. Arsb. Stockholm, **1831**: 328. 1831.

Autoicous; very slender plants; stems 1–2 cm. long, freely branched. Leaves squarrose-spreading, 0.7–0.9 mm. long, long and slenderly acuminate from an ovate, concave, subcordate base, minutely denticulate all around; costa lacking; cells linear, subquad-

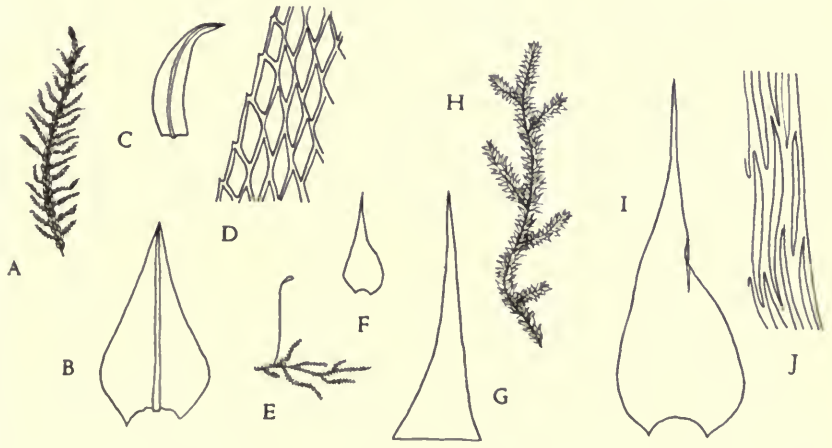

FIGURE 152

A–D, *Cratoneuron filicinum:* A, plant, ×1; B, stem leaf, ×14; C, branch leaf, ×14; D, upper leaf cells and margin, ×270.

E–G, *Campylium hispidulum* var. *Sommerfeltii:* E, plant, ×1; F, leaf, ×16; G, apex of leaf, ×110.

H–J, *Campylium stellatum:* H, plant, ×1; I, leaf, ×16; J, upper leaf cells and margin, ×320.

rate alar cells few and inconspicuous. Seta slender, red, 1–1.5 cm. long; capsule oblong, arcuate, urn 1 mm. long; lid conic-apiculate. (Fig. 152, E–G.)

Dept. San Marcos: *Steyermark 35871* in part. Dept. Quezaltenango: *Standley 86142*. Dept. Sacatepequez: *Standley 65198a* in part. Dept. Chimaltenango: *Standley 61518, 79783a*.

Distribution: Canada, United States, Mexico, Haiti, Europe, Asia.

On damp banks, rocks and trees mostly at high altitudes. Distinguished from the species by the much longer, finer leaf acumen.

2. CAMPYLIUM STELLATUM (Hedw.) Lang. & Jens., Consp. Fl. Groenl. 328. 1887.

Hypnum stellatum Hedw., Sp. Musc. 280. 1801.

Dioicous; relatively robust plants, pale or golden green, densely tufted; stems suberect, to 5 cm. long or longer, irregularly branched. Leaves crowded, squarrose-spreading, 2–3 mm. long, long and slenderly acuminate from an ovate base, entire; costa usually lacking; cells narrowly linear, incrassate, enlarged and subrectangular in a conspicuous group at basal angles. Fruit rare; sporophyte typical. (Fig. 152, H–J.)

Dept. Huehuetenango: *Steyermark 50027*. Dept. Totonicapan: *Standley 84496*.

Distribution: Northern United States and Canada, Europe, Asia.

Wet meadow and damp ground at high altitudes. These are highly instructive collections representing a remarkable leap in distribution but are closely paralleled by many other alpine mosses in the local region.

3. CAMPYLIUM CHRYSOPHYLLUM (Brid.) Bryhn, Expl. 61. 1893.

Hypnum chrysophyllum Brid., Musc. Recent. 2^2: 84. 1801.

Dioicous; slender, glossy, yellowish or golden green plants in intricate mats. Stems prostrate or decumbent, irregularly branched, rather rigid. Leaves squarrose-spreading, to 1.6 mm. long, linear-lanceolate from an ovate base, acuminate, carinate above, contracted and subcordate at insertion, slightly decurrent; margins erect, entire; costa single, ending near base of acumen; cells linear, alar group rather conspicuous, subrectangular, often colored. Seta elongate; capsule curved, cernuous; lid conic-apiculate. (Fig. 153, A–C.)

Dept. Huehuetenango: *Sharp 4979, 4855, 4914.*

Distribution: Northern North America south to the Gulf of Mexico, New Mexico, Arizona, West Indies.

On limestone boulders and bluffs at moderate altitudes. Again the southward extension of northern types is emphasized by the occurrence of this species in the calcareous regions of Huehuetenango.

3. LEPTODICTYUM (Schimp.) Warnst., Laubm. Kryptogamefl. Mark Brand. **2**: 840. 1906.

Amblystegium subg. *Leptodictyum* Schimp., Syn. Ed. 1, 595. 1860.

Plants aquatic or subaquatic; stems creeping or floating, irregularly branched. Leaves spreading, plane margined, acuminate, entire; costa single, well developed; cells linear. Sporophyte as in *Amblystegium*.

1. LEPTODICTYUM RIPARIUM (Hedw.) Warnst., Laubm. Kryptogamefl. Mark Brand. **2**: 878. 1906.

Hypnum riparium Hedw., Sp. Musc. 241. 1801.

Autoicous; stems elongate, branches short, spreading, often complanate-foliate. Leaves rather distant, widely spreading, to 2.5 mm. long, ovate-lanceolate, acuminate, flat at apex; costa strong, ending

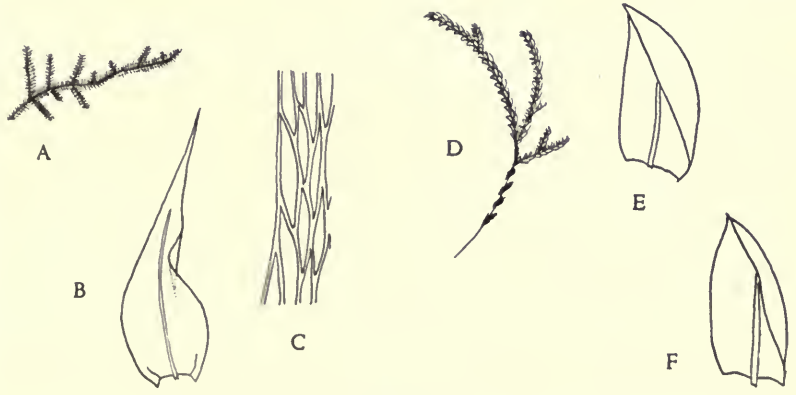

FIGURE 153

A–C, *Campylium chrysophyllum:* A, plant, ×1; B, leaf, ×24; C, upper leaf cells and margin, ×338.

D–F, *Hygrohypnum palustre:* D, plant, ×1; E and F, leaves, ×14.

above mid-leaf; cells linear, shorter and broader near insertion. Seta to 2.5 cm. long; capsule arcuate, oblong. (Fig. 154, A–C.)

Dept. Alta Verapaz: *Steyermark 45012*. Dept. Jalapa: *Steyermark 32912*.

Distribution: Wide in Canada and United States, Europe, Asia, Africa.

Submerged or in wet places at low to medium altitudes. A very protean species with numerous closely interrelated forms that are difficult to separate satisfactorily. A comparative study of the species credited to tropical North America will probably suggest more extensive distribution than outlined above.

4. HYGROAMBLYSTEGIUM Loeske, Moosfl. d. Harz. 298. 1903.

Plants aquatic or subaquatic, dull green; stems irregularly branched. Leaves erect-spreading, plane margined; costa very strong, percurrent or excurrent; cells rhomboidal. Sporophyte as in *Amblystegium*.

1. Hygroamblystegium fluviatile (Hedw.) Loeske, Moosfl. d. Harz. 299. 1903.

Hypnum fluviatile Hedw., Sp. Musc. 277. 1801.

Plants floating. Leaves oblong-lanceolate, tapering to a blunt point, entire, concave; costa very stout, scarcely tapering upward, percurrent; cells narrowly hexagonal, basal cells thick walled and often colored.

This species is credited to Guatemala by Brotherus (Pflanzenf. Ed. 2, **11**: 337. 1925) but I have seen no local material to substantiate the claim.

5. AMBLYSTEGIUM Bry. Eur. fasc. 55–56. 1853.

Plants small, terrestrial, growing in moist places; stems creeping, freely branched. Leaves erect-spreading, ovate-lanceolate, concave; margins plane; cells rather short, prosenchymatous. Seta elongate, smooth; capsules horizontal, arcuate, subcylindric, constricted under mouth when dry; lid conical; peristome complete.

1. Costa percurrent ..... 3. *A. varium*
   Costa ending near mid-leaf 2
2. Leaves spreading, marginal cells of leaf base rectangular ... 2. *A. Juratzkanum*
   Leaves erect-spreading, marginal cells of leaf base quadrate ..... 1. *A. serpens*

1. AMBLYSTEGIUM SERPENS (Hedw.) Bry. Eur. fasc. 55–56. 1853.

Hypnum serpens Hedw., Sp. Musc. 268. 1801.

Autoicous; small, slender plants in thin, intricate mats; stems irregularly branched. Leaves erect-spreading, ovate-lanceolate, long acuminate, to 1 or 1.2 mm. long, serrulate or subentire; costa slender, to or beyond mid-leaf; cells narrowly rhomboidal, broader below, quadrate or transversely rectangular at basal margins. Seta 1.5–3 cm. long; capsule cylindrical, arcuate, cernuous. (Fig. 154, D–F.)

Dept. San Marcos: *Steyermark 36875, 36888.* Dept. Quezaltenango: *Standley 65488, 87040, 87056.*

Distribution: Nearly cosmopolitan.

On moist banks and rocks at medium to high altitudes. These collections are all sterile and the leaf cells average longer than usual but I think the specimens can safely be referred here.

2. AMBLYSTEGIUM JURATZKANUM Schimp., Syn. Ed. 1, 693. 1860.

Plants similar to *A. serpens* but with the leaves more widely spreading both moist and dry, serrulate; costa extending well above mid-leaf; marginal cells at basal angles rectangular. (Fig. 154, G–H.)

Dept. Huehuetenango: *Standley 81567.*

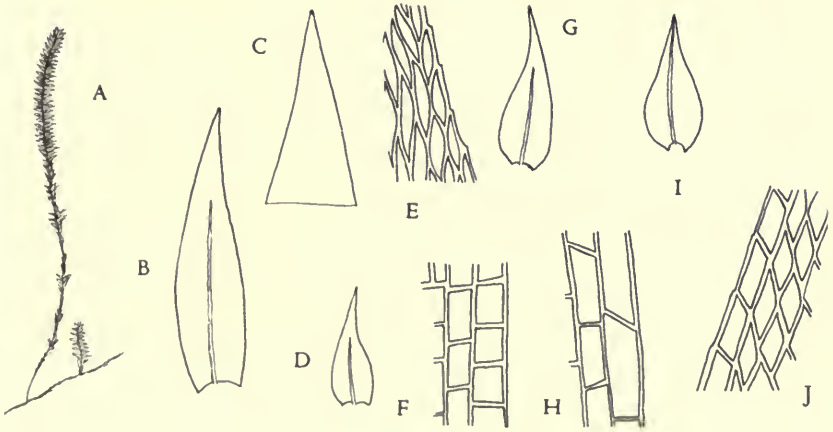

FIGURE 154

A–C, *Leptodictyum riparium:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×54.
D–F, *Amblystegium serpens:* D, leaf, ×14; E, upper leaf cells and margin, ×270; F, basal margin of leaf, ×270.
G–H, *Amblystegium Juratzkanum:* G, leaf, ×14; H, basal margin of leaf, ×270.
I–J, *Amblystegium varium:* I, leaf, ×14; J, upper leaf cells and margin, ×270.

Distribution: Canada, United States, Europe, Asia.

On wet rocks at medium altitude. The distinctions between this species and *A. serpens* are admittedly weak. The elongated marginal cells at the leaf base are evident in this collection.

3. AMBLYSTEGIUM VARIUM (Hedw.) Lindb., Musc. Scand. 32. 1872.

Leskea varia Hedw., Sp. Musc. 216. 1801.

Autoicous; plants sordid green, rather densely matted. Stem leaves ovate-lanceolate, slenderly acuminate, subentire, slightly concave, 1–1.4 mm. long; costa strong, tapering upward, ending in acumen; cells oval-hexagonal, 2–4:1, more lax and rectangular toward base, subquadrate at basal margins. Branch leaves smaller and shorter pointed. Sporophyte as in *A. serpens*. (Fig. 154, I–J.)

Dept. Huehuetenango: *Standley 81381*.

Distribution: Canada, United States, Mexico, Bermuda, Europe, Asia.

On wet banks at moderate altitude. This collection agrees in every essential way with the average run of the species in the United States.

6. HYGROHYPNUM Lindb., Act. Soc. Fenn. **10**: 277. 1872.

Plants glossy, growing in dense, deep tufts. Stems branched, sparingly radiculose. Leaves crowded, often secund, ovate-lanceolate, short pointed, concave; costa variable, short and double or single and forked; cells linear, smooth, often well differentiated at basal angles. Seta elongate; capsules nodding, asymmetrical; peristome double.

1. HYGROHYPNUM PALUSTRE (Hedw.) Loeske, Moosfl. d. Harz. 319. 1903.

Hypnum palustre Hedw., Sp. Musc. 292. 1801.

Dioicous; robust, glossy, green or golden green plants in deep, silted tufts. Stems to 4 cm. long, profusely and irregularly branched, densely foliate. Leaves secund, broadly ovate, short acuminate, entire, 1.5 mm. long, 1 mm. wide; costa single, extending well above mid-leaf or shorter and forked; cells linear, small and rather incrassate at basal angles, forming a poorly defined alar group. (Fig. 153, D–F.)

Dept. El Quiche: *Sharp 2344, 2455*.

Distribution: Northern United States and Canada south to Pennsylvania and Colorado.

On wet travertine in edge of river at moderate altitudes. This is a highly significant addition to the local flora but at the same time strictly in line with the presence of so many other northern temperate types in the area. These seem to be the only records for the species south of the Mexican border.

7. DREPANOCLADUS (C. M.) Roth., Hedwigia **38**: Beibl. 6. 1899.

Hypnum Subsec. *Drepanocladus* C. M., Syn. **2**: 321. 1851.

Slender to robust plants; stems creeping or ascending, paraphyllia few or none, irregularly branched, usually hooked at tips of stems and branches. Leaves falcate-secund, acuminate; costa single, well developed; cells linear, smooth, often conspicuously enlarged at basal angles. Seta elongate; capsules horizontal, curved; peristome complete.

Slender plants, leaves to 2 mm. long, alar cells thin walled, hyaline
1. *D. exannulatus*

Robust plants, leaves 4 mm. long, alar cells thick walled and colored
2. *D. aduncus*

1. DREPANOCLADUS EXANNULATUS (Guemb.) Warnst. var. MEXICANUS (Mitt.) Card., Rev. Bryol. **37**: 54. 1910.

Hypnum mexicanum Mitt. in sched.

Dioicous; slender yellowish green plants in rather dense tufts; stems to 5 or 6 cm. long, irregularly pinnate. Leaves falcate-secund; stem leaves 2 mm. long, 1 mm. wide, long subulate-acuminate from a broadly ovate, slightly decurrent base, subentire; costa strong, ending in acumen; cells narrowly linear, shorter and broader at extreme base, alar group oblong, inflated, hyaline, extending about half way to costa. Branch leaves smaller, narrower, more gradually acuminate. Sporophyte not seen. (Fig. 155, A–C.)

Dept. Quiche: *Standley 62479*. Dept. Huehuetenango: *Standley 81328, 82401*. Dept. Sacatepequez: *Standley 64711*. Dept. Baja Verapaz: *Standley 69583, 69589, 69604* (as *Cratoneuron falcatum*).

Distribution: Mexico.

In marshes, wet meadows and on wet banks at medium altitudes. Locally abundant but uniformly sterile.

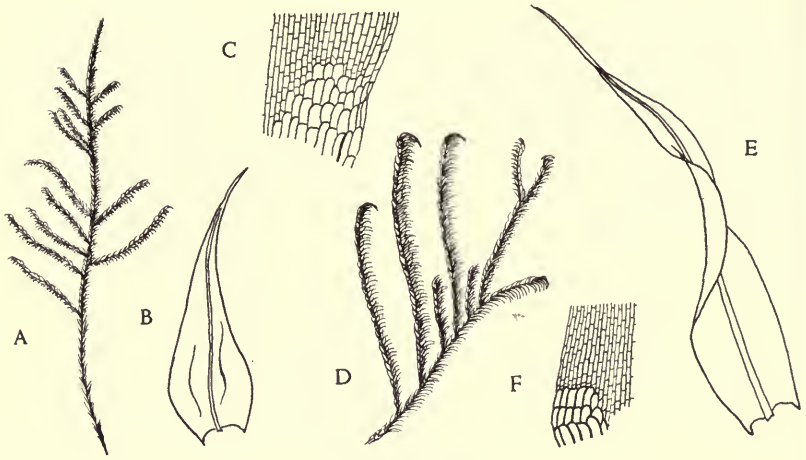

FIGURE 155

A–C, *Drepanocladus exannulatus* var. *mexicanus:* A, plant, ×1; B, leaf, ×16; C, basal angle of leaf, ×110.

D–F, *Drepanocladus aduncus:* D, plant, ×1; E, leaf, ×16; F, basal angle of leaf, ×110.

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2. DREPANOCLADUS ADUNCUS (Hedw.) Warnst., Beih. Bot. Centralb. **13**: 400. 1903.

Hypnum aduncum Hedw., Sp. Musc. 295. 1801.

Dioicous; plants robust, vivid green, brown below, growing in rather dense mats; stems to 7 cm. long, irregularly branched. Stem leaves laxly falcate-secund, to 4 mm. long, gradually long filiform-acuminate from an ovate base, channeled above, entire; costa strong, extending well into acumen; cells narrowly linear, broader near insertion, alar group oblong, inflated, with thickened, colored walls. (Fig. 155, D–F.)

Dept. Totonicapan: *Standley 84486* (as *D. Sendtneri*).

Distribution: Wide in northern United States and Canada; also in Europe, Asia, South America, New Zealand.

On wet bank at high altitude. Dr. Frances E. Wynne, who has recently completed a critical study of the North American species, suggests that this collection represents the forma *aquaticus* (Sanio) Moenkem. It is a significant addition to the local flora.

42. BRACHYTHECIACEAE

Plants slender to medium sized, usually glossy, growing in dense tufts or mats; stems creeping or ascending, mostly irregularly

branched. Leaves erect-spreading, ovate-lanceolate, often plicate; costa single, ending in upper half of leaf; cells linear, frequently differentiated at basal angles. Seta elongate, smooth or papillose; capsules ovoid, horizontal, seldom erect; lid conical, short beaked; peristome usually complete.

1. Capsules erect 2
   Capsules inclined or horizontal 3
2. Leaves plicate ..... 1. *Pleuropus*
   Leaves not plicate ..... 2. *Homalotheciella*
3. Lid short, conical ..... 3. *Brachythecium*
   Lid long and slenderly beaked ..... 4. *Eurhynchium*

1. PLEUROPUS Griff., Not. 468; Pl. Asiat. **2**: pl. 90. 1849.

Rather robust glossy plants in loose mats; stems prostrate, branched, branches ascending, densely foliate. Leaves acuminate, plicate; costa ending near apex; cells linear, rounded-quadrate at basal angles. Seta smooth; capsules erect; peristome teeth striolate, segments filiform, shorter than teeth.

1. PLEUROPUS BONPLANDII (Hook.) Broth., E. & P. Pflanzenf. **1**[3]: 1138. 1908.

Leskea Bonplandii Hook., Kunth, Syn. Pl. Aequin. **1**: 61. 1822–28.

Dioicous; plants green or yellowish green; stems to 6 or 7 cm. long, irregularly branched. Branch leaves erect-spreading or secund, glossy, plicate, 2.5–3 mm. long, ovate-lanceolate from a subcordate base, gradually subulate-acuminate; margins recurved at extreme base, plane above, serrulate all around; costa slender, ending near base of acumen; cells narrowly linear, vermicular, rounded-quadrate and incrassate in a rather conspicuous group at basal angles. Seta to 1.5 cm. long, smooth; capsule erect, ovoid-cylindric, urn 2 mm. long. (Fig. 156, A–C.)

Dept. Huehuetenango: *Standley 81739, 81747, 81852a.* Dept. San Marcos: *Steyermark 35681a, 35682, 35859; Standley 85395.* Dept. Quezaltenango: *Standley 65969, 67601, 84186, 84288, 84296, 84297, 85216; Steyermark 34723c, 34725, 34728.* Dept. Sacatepequez: *Standley 65100, 65213.* Dept. Solola: *Steyermark 47567, 47568b.* Dept. Chimaltenango: *Standley 57812, 58781b.* Dept. Baja Verapaz: *Standley 91042.*

Distribution: Texas, Mexico, West Indies, Central and South America.

On trees, rocks and banks mostly at high altitudes. Quite variable in habit but readily known by the plicate leaves usually with a vitreous sheen.

2. HOMALOTHECIELLA Card., Bryol. 7: 31. 1904.

Small plants; stems creeping, subpinnate, branches short. Branch leaves imbricated, ovate, not plicate, costate to near middle; cells linear, quadrate across lower part of leaf. Seta short, scabrous; capsules suberect; lid conic-rostrate; peristome double, segments adherent to teeth; calyptra pilose.

1. HOMALOTHECIELLA TENERRIMA (C. M.) Card., Bry. 7: 31. 1904.

Hypnum tenerrimum C. M., Bot. Zeit. 456. 1856.

Rhynchostegium tenerrimum C. M., Bull. Herb. Boiss. 5: 219. 1897.

"Plants slender, flexuous, yellowish. Stem leaves spreading, minute, gradually subulate from a short, concave base; costa lacking or short and slender, denticulate all around. Seta short; capsule minute, ovoid, erect."

No trace of this plant can be found in New York. Brotherus had not seen it and it was evidently unfamiliar to Cardot. It is a highly problematical species and if the type cannot be located it might better be ignored.

3. BRACHYTHECIUM Bry. Eur. fasc. 52–54. 1851.

Plants medium sized, irregularly branched, often glossy. Leaves ovate-lanceolate, acuminate, often plicate; costa single, ending above mid-leaf; cells linear, broader and shorter below, often subquadrate at basal angles. Seta elongate, smooth or papillose; capsules short, ovoid, nodding; lid conical, short pointed; peristome complete.

1. Seta scabrous above or throughout 2
   Seta smooth 3

2. Seta scabrous above, smooth below ..... 4. *B. plumosum*
   Seta scabrous to base ..... 5. *B. rutabulum*

3. Stems slender, capsules suberect, leaves erect when dry, filiform-acuminate ..... 1. *B. stereopoma*
   Capsules curved or inclined, leaves erect-spreading when dry, shorter acuminate 4

4. Plants whitish green, setae 20–22 mm. long ..... 3. *B. alboflavens*
   Plants yellowish, setae 8–10 mm. long ..... 2. *B. flexiventrosum*

1. BRACHYTHECIUM STEREOPOMA (Spruce) Jaeg., Adumb. **2**: 393. 1876–77.

Hypnum stereopoma Spruce, Journ. Linn. Soc. **12**: 561. 1869.

?Brachythecium trochalobasis C. M., Bull. Herb. Boiss. **5**: 218. 1897.

?Brachythecium pusillo-albicans C. M., Bull. Herb. Boiss. **5**: 218. 1897.

?Brachythecium crocatum Hampe, Bull. Herb. Boiss. **5**: 218. 1897.

Dioicous; plants slender, pale or yellowish green, glossy, in dense, silky mats; stems to 5 cm. long, often shorter, freely branched. Leaves laxly erect-imbricated; stem leaves 1.5 mm. long, 0.6 mm. wide, ovate-lanceolate, gradually long and finely acuminate, faintly plicate; margins serrulate all around, slightly recurved below and often toward apex; costa slender, ending slightly above mid-leaf; cells linear, subquadrate alar cells numerous, extending nearly to costa. Branch leaves smaller and narrower, biplicate. Seta about 15 mm. long, reddish, smooth; capsule oblong-cylindric, slightly inclined, urn 1.5–2 mm. long; lid conical, 0.5 mm. long. (Fig. 156, D–F.)

Dept. Alta Verapaz: *Standley 89872*. Dept. Quiche: *Standley 62473*. Dept. Huehuetenango: *Standley 65723, 81288, 81569, 82409, 82785, 83029*. Dept. San Marcos: *Steyermark 35757, 36548, 36648; Standley 66121*. Dept. Totonicapan: *Standley 84029, 84123*. Dept. Quezaltenango: *Standley 65501, 65503, 65558a, 66481, 66489, 67599a, 83195, 83396a, 83454, 83542, 83570, 83810, 83819, 84164,*

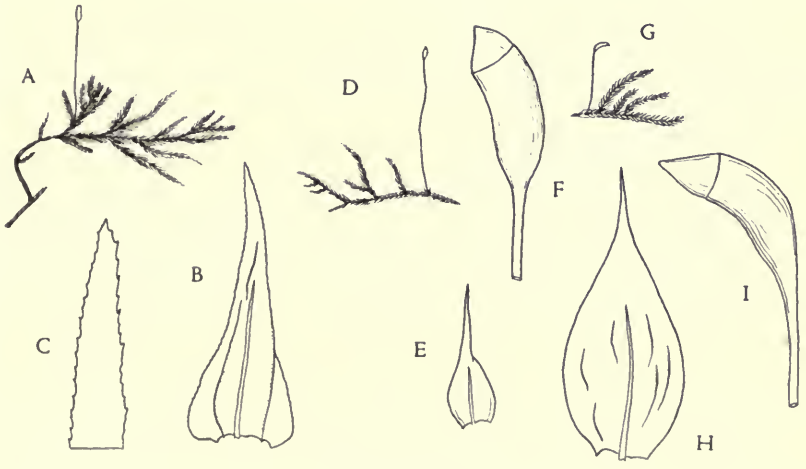

FIGURE 156

A–C, *Pleuropus Bonplandii:* A, plant, ×1; B, leaf, ×14; C, apex of leaf, ×54. D–F, *Brachythecium stereopoma:* D, plant, ×1; E, leaf, ×14; F, capsule, ×8. G–I, *Brachythecium flexiventrosum:* G, part of plant, ×1; H, leaf, ×14; I, capsule, ×8.

86146. Dept. Sacatepequez: *Standley 58824, 58918, 59488, 59499a, 61178, 61230, 89006*. Dept. Chimaltenango: *Standley 79818, 80206, 80938, 81073*. Dept. Guatemala: *Standley 63026*. Dept. Baja Verapaz: *Standley 91081*. Dept. Jalapa: *Standley 76477*.

Distribution: Mexico, West Indies, Central and South America.

On damp banks, tree trunks, logs and rocks at medium altitudes. A widely distributed, elastic species which I imagine has an extensive synonymy. The plants have a characteristic silky appearance due to the erect, finely acuminate leaves.

2. BRACHYTHECIUM FLEXIVENTROSUM (C. M.) Jaeg., Adumb. **2**: 387. 1876–77.

Hypnum flexiventrosum C. M., Linnaea **38**: 653. 1874.

Dioicous; more robust than *B. stereopoma*, plants yellowish green, glossy, in dense mats; stems about 3 cm. long, freely branched. Leaves crowded, flexuous and erect-spreading when dry; stem leaves 2.5 mm. long, ovate-lanceolate, rather abruptly long and finely acuminate, plicate; margins slightly recurved near base, serrulate all around; costa slender, ending above mid-leaf; cells linear, 8–10 μ wide, shorter at base, subquadrate and pellucid at basal angles. Seta 8–10 mm. long, smooth; capsule arcuate, subhorizontal, urn cylindrical, 2 mm. long; lid conical, 1 mm. long. (Fig. 156, G–I.)

Dept. Alta Verapaz: *Standley 70454, 89851*. Dept. San Marcos: *Steyermark 36087, 36098*. Dept. Quezaltenango: *Steyermark 34075, 34082, 34094, 34139, 34140, 34141*. Dept. Sacatepequez: *Standley 59486, 65190*. Dept. Chimaltenango: *Standley 61854, 61908, 62005*.

Distribution: Mexico.

On tree trunks, banks and boulders at medium to high altitudes. Most of these collections are sterile and have been referred here with considerable reservation. Until the various Mexican species in the Section *Salebrosa* are resolved one can hardly do more than guess at the specific names.

3. BRACHYTHECIUM ALBOFLAVENS Card., Rev. Bryol. **37**: 68. 1910.

Dioicous; plants pale yellow or whitish green, in lax tufts; stems 5–6 cm. long, irregularly pinnate, branches often attenuate. Stem leaves 2.5 mm. long, 1.5 mm. wide, broadly ovate-lanceolate, slenderly acuminate, decurrent, faintly plicate; margins minutely serrulate, plane or slightly reflexed; costa slender, ending $\frac{2}{3}$ up; cells linear,

subrectangular alar cells numerous. Seta smooth, to 22 mm. long; capsule arcuate, cylindric, urn 2.5–3 mm. long. (Fig. 157, A–C.)

Dept. Huehuetenango: *Steyermark 50047.*

Distribution: Mexico.

On tree at rather high altitude. Doubtfully distinct from *B. flexiventrosum.* The pale color and longer setae may have only a relative value.

4. BRACHYTHECIUM PLUMOSUM (Hedw.) Bry. Eur. fasc. 52–54. 1853.

Hypnum plumosum Hedw., Sp. Musc. 257. 1801.

Autoicous; plants brownish, paler at tips; stems creeping, branches ascending. Branch leaves erect-spreading, often secund, 1–1.5 mm. long, ovate-lanceolate, acuminate, concave, serrulate above; costa ending ⅔ up; cells linear, quadrate alar cells few. Seta 6–15 mm. long, dark brown, scabrous above, smooth below; capsule inclined to horizontal, urn 1–1.5 mm. long, slightly arcuate. (Fig. 157, D–F.)

Dept. Totonicapan: *Standley 65944.* Dept. Quezaltenango: *Standley 83683, 83709.*

Distribution: Canada, United States, almost cosmopolitan.

On wet rocks and banks at high altitudes. A widely distributed species but not previously recorded from Central America.

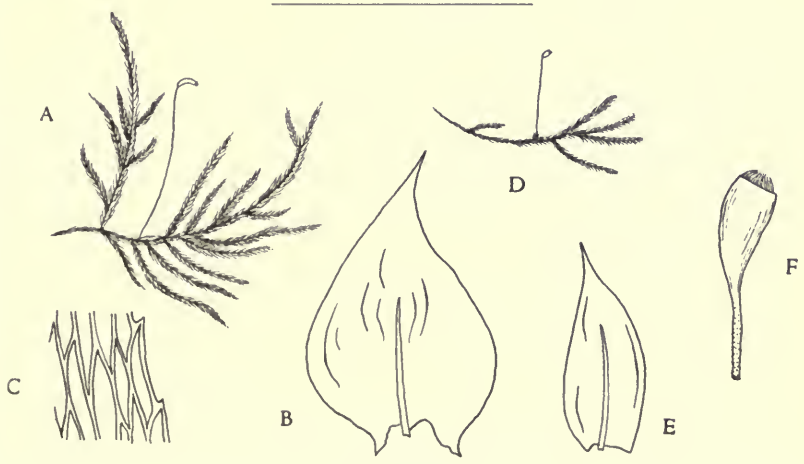

FIGURE 157

A–C, *Brachythecium alboflavens:* A, part of plant, ×1; B, stem leaf, ×14; C, upper leaf cells and margin, ×270.

D–F, *Brachythecium plumosum:* D, plant, ×1; E, leaf, ×14; F, capsule, ×8.

5. BRACHYTHECIUM RUTABULUM (Hedw.) Bry. Eur. fasc. 52–54. 1853.

Hypnum rutabulum Hedw., Sp. Musc. 276. 1801.

Autoicous; robust, glossy, pale green plants in extensive, loose mats; stems to 6 cm. long, arched, freely branched, branches attenuate, complanate-foliate. Stem leaves 3–3.5 mm. long, 1.5 mm. wide, broadly ovate, rather abruptly acuminate, decurrent; cells linear, more lax below, enlarged and inflated at basal angles; costa ending about ⅔ up. Branch leaves smaller, ovate-lanceolate, gradually acuminate, more strongly toothed. Seta 2–2.5 cm. long, scabrous throughout; capsule oblong, arcuate, urn 2.5–3 mm. long; lid conical, 1 mm. long. (Fig. 158, A–C.)

Dept. San Marcos: *Steyermark 36011*. Dept. Quezaltenango: *Standley 67595, 67607, 67611, 67614, 67672, 67674, 67681, 67750; Steyermark 34097, 34141a, 34142*. Dept. Sacatepequez: *Standley 65194*. Dept. Chimaltenango: *Standley 61850, 61913*.

Distribution: Canada, northern United States, South America, Europe, Asia, Africa, New Zealand.

On damp banks and trees in alpine regions. These collections average more robust than the usual run of the species but as there are no structural differences I doubt if they are specifically distinct, especially as the species is notoriously variable.

4. EURHYNCHIUM Bry. Eur. fasc. 57–61. 1854.

Plants medium sized, growing in extensive mats; stems creeping, subpinnately branched. Branch leaves usually acuminate, serrulate, concave; costa single, to or beyond mid-leaf; cells linear, broader and shorter below and often shorter at apex. Seta elongate, smooth or papillose; capsules horizontal; lid long and slenderly beaked; peristome complete.

1. Apical cells of branch leaves short, broadly rhomboidal or oval.....2
   Apical cells of branch leaves not differentiated.....5
2. Seta scabrous above, smooth below.....2. *E. semiscabrum*
   Seta smooth throughout.....3
3. Terrestrial, stem leaves triangular-ovate from a cordate base..1. *E. pulchellum*
   Aquatic, stem leaves broadly ovate, acute or obtuse.....4
4. Robust plants, leaves widely spreading, 2 mm. or more long..3. *E. riparioides*
   Slender plants, leaves erect-spreading, 1–1.25 mm. long....4. *E. subrusciforme*
5. Seta scabrous throughout.....5. *E. praelongum*
   Seta smooth.....6

6. Stems strongly complanate-foliate, leaves spreading.....6. *E. huitomalconum*
   Stems not complanate-foliate, leaves laxly erect.....7
7. Stems robust, leaves broadly ovate, 2–2.5 mm. long.....7. *E. blandum*
   Stems slender, leaves ovate-lanceolate, less than 2 mm. long...8. *E. scariosum*

1. EURHYNCHIUM PULCHELLUM (Hedw.) Jennings, Man. Mosses W. Pa. 350. 1913.

Hypnum strigosum Hoffm., D. Fl. 2: 76. 1796.
Hypnum pulchellum Bridelii Hedw., Sp. Musc. 265. 1801.
Eurhynchium strigosum (Hoffm.) Bry. Eur. fasc. 57–61. 1854.

Dioicous; plants yellowish green in extensive, soft mats; stems creeping, elongate, pinnate, branches suberect, attenuate, somewhat flattened. Stem leaves about 1 mm. long, triangular-ovate, slenderly acuminate; branch leaves ovate-lanceolate, short acuminate, concave, sharply serrate; costa ending in a dorsal spine near base of acumen; apical cells short, rhomboidal, median cells linear, subquadrate alar cells few. Seta 1–2 cm. long, smooth; capsule oblong, subhorizontal; lid slenderly beaked, over half as long as urn. (Fig. 158, D–G.)

Dept. Huehuetenango: *Standley 83090.* Dept. Quezaltenango: *Steyermark 34734.*

Distribution: Canada, northern United States, Europe, Africa, Asia.

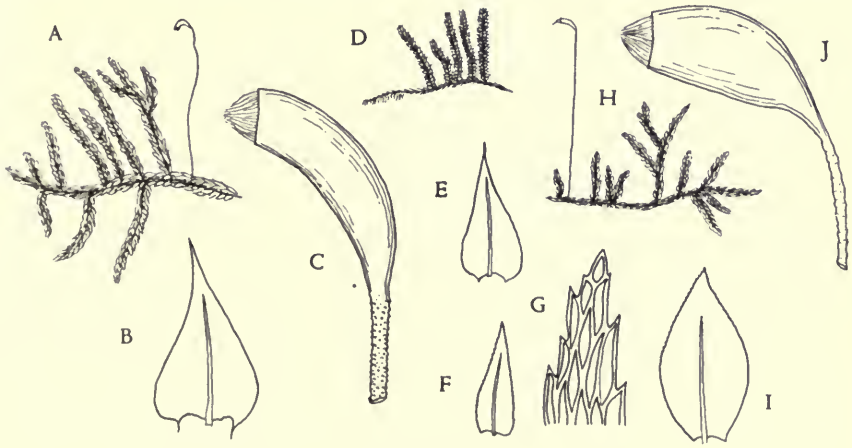

FIGURE 158

A–C, *Brachythecium rutabulum:* A, part of plant, ×1; B, stem leaf, ×8; C, capsule, ×8.

D–G, *Eurhynchium pulchellum:* D, plant, ×1; E, stem leaf, ×14; F, branch leaf, ×14; G, apex of branch leaf, ×270.

H–J, *Eurhynchium semiscabrum:* H, plant, ×1; I, leaf, ×14; J, capsule, ×10.

Shaded banks in alpine regions. Both of these significant collections show the branch leaves more widely spreading than usual but differ in no essential way from similar forms from the north.

2. EURHYNCHIUM SEMISCABRUM Bartr., Bryol. **49**: 120. 1946.

Yellowish green plants in loose mats; stems irregularly branched, prostrate, branches slightly curved when dry. Leaves spreading on all sides, scarious, ovate, 1.5 mm. long, 0.75 mm. wide; margins strongly and sharply serrate all around; costa ending about ¾ up leaf, often ending in a dorsal spine; leaf cells linear, shorter and rhomboidal in acumen, subrectangular across insertion. Seta 22–24 mm. long, stout, red, smooth below, rough with low papillae toward apex; capsule large, horizontal, urn 2 mm. long, oblong; lid long rostrate from a conical base; peristome teeth dark brown, 0.6 mm. long, segments as long as teeth, split along median line, cilia 2, nodose; spores 12–15 μ. (Fig. 158, H–J.)

Dept. Huehuetenango: Near Chiantla along the river south and east of the town, alt. about 1,930 m., *Standley 82478a* TYPE.

Endemic.

On damp, shaded bank. Suggestive of *E. hians* (Hedw.) in many ways but distinctive in the setae, which are smooth below.

3. EURHYNCHIUM RIPARIOIDES (Hedw.) Richards, Ann. Bryol. **9**: 135. 1936.

Hypnum rusciforme Neck., Delic. Gall.-Belg. **2**: 481. 1768.

Hypnum riparioides Hedw., Sp. Musc. 242. 1801.

Eurhynchium rusciforme (Neck.) Milde, Bryol. Siles. 312. 1869.

Plants usually robust, dull brownish green, paler at tips; stems elongate, wiry, freely branched, branches rigid. Leaves not crowded, spreading and contorted when dry, broadly ovate, to 2.5 mm. long, 1.5 mm. wide, broadly acute to obtuse, denticulate nearly all around; costa strong, extending about ¾ up, often ending in a dorsal spine; cells linear, shorter at apex and more lax below. Seta smooth, 10–12 mm. long; capsule ovoid-oblong; lid with a long, curved beak. (Fig. 159, A–C.)

Dept. Alta Verapaz: *Standley 70554, 89845, 89848, 89850, 89858a.* Dept. Huehuetenango: *Steyermark 49663; Standley 81100, 81336, 82409a.* Dept. San Marcos: *Steyermark 35712, 36460, 37724.* Dept. Totonicapan: *Standley 65925.* Dept. Quezaltenango: *Standley 65480, 87041, 87049, 87053.* Dept. Chimaltenango: *Standley 64348.*

Distribution: Canada, United States, Mexico, Costa Rica, West Indies, South America, Europe, Asia, Africa.

On wet rocks, banks and trees at medium to high altitudes. A widely distributed, variable species which probably includes *Hypnum aquaticum* Hampe (Linnaea **1863:** 61) along with a much more extensive synonymy.

4. EURHYNCHIUM SUBRUSCIFORME (C. M.) Bartr., Bryol. **49:** 121. 1946.

Hypnum subrusciforme C. M., Linnaea **38:** 658. 1874.

Autoicous; plants dark green, similar to *E. riparioides* but smaller. Leaves 1–1.25 mm. long, 0.5 mm. wide, ovate, acute or obtuse, concave, serrulate; costa extending ¾ up leaf and often ending in a minute dorsal spine; cells linear, shorter and oval-rhomboidal in acumen, more lax at extreme base. Seta 12–15 mm. long, smooth; capsule inclined, urn 1.5 mm. long; lid obliquely and slenderly beaked, 1.25 mm. long; calyptra cucullate. (Fig. 159, D–F.)

Dept. Alta Verapaz: *Steyermark 44099, 44766.* Dept. San Marcos: *Steyermark 36655, 36897a, 36900.* Dept. Quezaltenango: *Steyermark 35162, 35164; Standley 85817.* Dept. Retalhuleu: *Steyermark 34549.* Dept. Suchitepequez: *Steyermark 35311.* Dept. Guatemala: *Standley 62905.*

Distribution: Mexico.

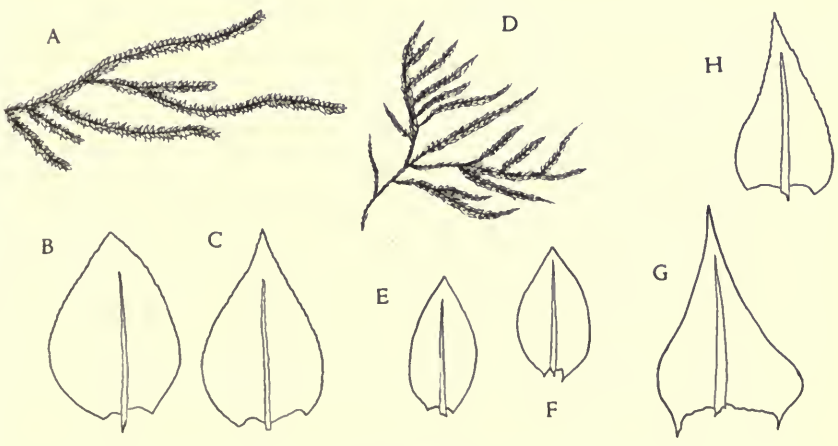

FIGURE 159

A–C, *Eurhynchium riparioides:* A, plant, ×1; B and C, leaves, ×14.
D–F, *Eurhynchium subrusciforme:* D, plant, ×1; E and F, leaves, ×14.
G–H, *Eurhynchium praelongum:* G, stem leaf, ×26; H, branch leaf, ×26.

On wet rocks and banks at low to medium altitudes. Consistently smaller than *E. riparioides* with shorter, narrower leaves but otherwise lacking any distinctive characters.

5. EURHYNCHIUM PRAELONGUM (Hedw.) Hobk., Syn. Br. Mosses Ed. 2. 1884.

Hypnum praelongum Hedw., Sp. Musc. 258. 1801.

Hypnum exasperatum Hampe, Linnaea **32**: 162. 1863.

Dioicous; plants slender, yellowish green; stems creeping, pinnate, branches divergent, curved, attenuate. Stem leaves scattered, quickly acuminate from a cordate-ovate base, decurrent; costa slender, reaching base of acumen; cells linear, more lax at base, large and subrectangular at basal angles. Branch leaves narrower, ovate-lanceolate, gradually acuminate. Seta 2–2.5 cm. long, scabrous throughout; capsule ovoid, horizontal; lid subulate-rostrate. (Fig. 159, G–H.)

Dept. San Marcos: *Steyermark 35711, 36009.*

Distribution: Western United States, New Hampshire, Mexico, Costa Rica, South America, Europe, Asia.

On wet rocks and banks at high altitudes. These collections show the plants rather regularly pinnate, thus tending toward the var. *Stokesii* (Turn.) Dixon.

6. EURHYNCHIUM HUITOMALCONUM (C. M.) Bartr., Bryol. **49**: 121. 1946.

Hypnum huitomalconum C. M., Syn. **2**: 248. 1851.

?Rhynchostegium guatemalense Thér., Rev. Bryol. et Lichen. **8**: 57. 1934.

Autoicous; plants yellowish green, glossy, in thin, intricate mats; stems irregularly branched, complanate-foliate, 3.5–4 mm. wide. Leaves widely spreading, to 2 mm. long, ovate-lanceolate, acuminate, serrulate above; costa slender, reaching about ⅔ up; cells linear, shorter and broader across insertion. Seta smooth, to 2 cm. long; capsule horizontal, oblong, urn 1.5–2 mm. long; lid subulate-rostrate, curved, 1.5 mm. long. (Fig. 160, A–C.)

San Marcos: *Standley 68925.* Dept. Sacatepequez: *Standley 66900.* Dept. Jalapa: *Steyermark 32480.*

Distribution: Mexico.

On trees and logs at moderate altitudes. This species is uncomfortably close to *E. serrulatum* (Hedw.) Kindb. and will probably have to be combined with it eventually.

7. EURHYNCHIUM BLANDUM (Hampe) Bartr., Bryol. **49**: 121. 1946.

Rhynchostegium blandum Hampe, Prodr. Bryol. Mex. 107. 1871.

Autoicous; plants rather robust, pale yellowish, glossy, in dense, intricate mats; stems creeping, freely branched. Leaves crowded, erect-spreading, scarious, not or very slightly complanate, to 2.5 mm. long, 1 mm. wide, gradually acuminate from a broadly ovate base, sharply serrate above middle; costa slender, extending ¾ up; cells long and narrow, shorter across insertion. Seta smooth, 2–2.5 cm. long; capsule cylindric, urn 2 mm. long, contracted below mouth when dry; lid subulate-rostrate. (Fig. 160, D–E.)

Dept. Alta Verapaz: *Standley 71850.*

Distribution: Mexico.

On tree at moderate altitude. Much more robust than any collection of *E. scariosum* that I have seen.

8. EURHYNCHIUM SCARIOSUM (Tayl.) Bartr., Bryol. **49**: 121. 1946.

Hypnum scariosum Tayl., Lond. Journ. Bot. **5**: 65. 1846.

?Hypnum leptomerocarpum C. M., Syn. **2**: 354. 1851.

Autoicous; slender, yellowish green, glossy plants in thin mats; stems creeping, elongate, freely branched. Leaves spreading,

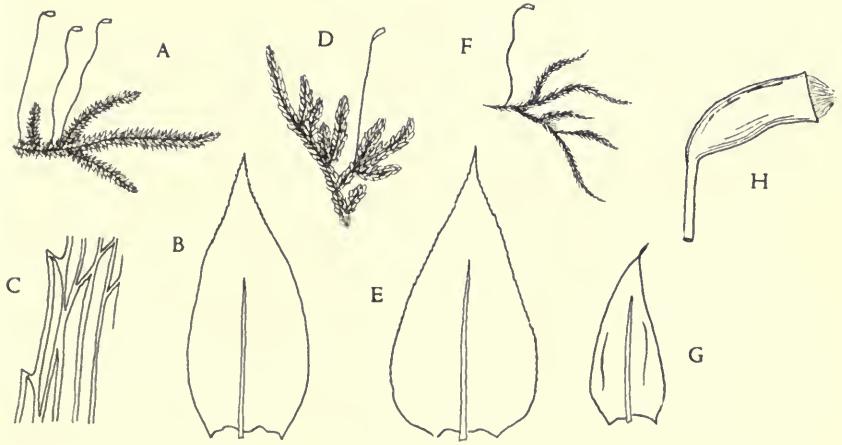

FIGURE 160

A–C, *Eurhynchium huitomalconum:* A, plant, ×1; B, leaf, ×16; C, upper leaf cells and margin, ×270.

D–E, *Eurhynchium blandum:* D, plant, ×1; E, leaf, ×16.

F–H, *Eurhynchium scariosum:* F, plant, ×1; G, leaf, ×16; H, capsule, ×10.

scarious, scarcely complanate, 1–2 mm. long, ovate-lanceolate, acuminate, serrulate; costa ending in a dorsal prickle about ¾ up leaf; cells linear, shorter and broader at basal angles and across insertion. Seta about 15 mm. long, smooth; capsule horizontal, oblong-cylindric, urn 1.5–2 mm. long; lid subulate-rostrate. (Fig. 160, F–H.)

Dept. San Marcos: *Steyermark 36651; Standley 85409.* Dept. Quezaltenango: *Standley 67652, 67663, 85611, 86131; Steyermark 34096.* Dept. Chimaltenango: *Standley 61875.* Dept. Guatemala: *Standley 80613.*

Distribution: Mexico, Central and South America.

On trees, moist banks and rocks at medium to high altitudes. Variable in size, often quite slender and rarely complanate-foliate or at least not noticeably so as in *E. huitomalconum.*

43. ENTODONTACEAE

Plants often glossy, in extensive mats; stems creeping, elongate, branches terete or flattened. Leaves ovate, concave; costa lacking or short and double, rarely single; upper cells linear, subquadrate at basal angles in numerous rows. Seta elongate, smooth; capsules erect, cylindrical; peristome double, segments narrow from a low basal membrane; lid conic-rostrate.

1. Costa single, to mid-leaf ..... 4. *Rozea*
   Costa double and short or none 2
2. Stems mostly terete-foliate, cells at basal leaf angles transversely elongated ..... 1. *Erythrodontium*
   Stems seldom terete-foliate, cells at basal leaf angles quadrate 3
3. Small plants, leaves secund, short pointed, often papillose at apical angles ..... 2. *Pterigynandrum*
   More robust plants, leaves not secund, smooth, usually acuminate ..... 3. *Entodon*

1. ERYTHRODONTIUM Hampe, Symb. 8: 279. 1870.

Slender to medium sized plants; stems creeping, branches densely foliate, julaceous, rigid. Leaves imbricated, ovate; costa lacking or very short and double; upper cells narrow, transversely oval in numerous rows at basal angles. Seta long; capsules erect; peristome teeth striolate, endostome rudimentary.

1. Autoicous 2
   Dioicous 3
2. Seta yellow ..... 2. *E. longisetum*
   Seta red ..... 1. *E. squarrosum*
3. Stems robust, leaves broadly ovate, abruptly acuminate ..... 4. *E. Pringlei*
   Stems very slender, leaves ovate-lanceolate, gradually acuminate ..... 3. *E. densum*

1. ERYTHRODONTIUM SQUARROSUM (C. M.) Par., Ind. Bryol. Ed. 2, **2**: 159. 1904.

Neckera squarrosa C. M., Syn. **2**: 100. 1851.

Autoicous; plants glossy, brownish yellow, in intricate mats; stems creeping or arched, irregularly pinnate, branches numerous, curved, julaceous. Leaves closely imbricated; branch leaves about 1 mm. long, 0.7 mm. wide, broadly ovate, abruptly short acuminate, concave, nearly entire; costa very short, double; cells linear, transversely rhomboidal in 8–12 rows at basal angles, extending nearly to costa. Inner perichaetial leaves erect, outer more or less recurved; seta reddish, 8–10 mm. long; capsule oblong, cylindric, urn to 2 mm. long; lid conic-rostrate, 0.5 mm. long; peristome teeth brownish, 200–225 μ high, divided at apex, transversely striolate at base, vertically striolate above, segments rudimentary. (Fig. 161, A–C.)

Dept. Jalapa: *Steyermark 32245*. Dept. Santa Rosa: *Standley 78566* (as *E. teres*).

Distribution: Mexico, Central and South America.

On rocks at rather low altitudes. The distinctions between this species and *E. teres* (C. M.) Par. are not convincing. The outer perichaetial leaves vary from suberect to squarrose-recurved and I doubt if the two species can be separated.

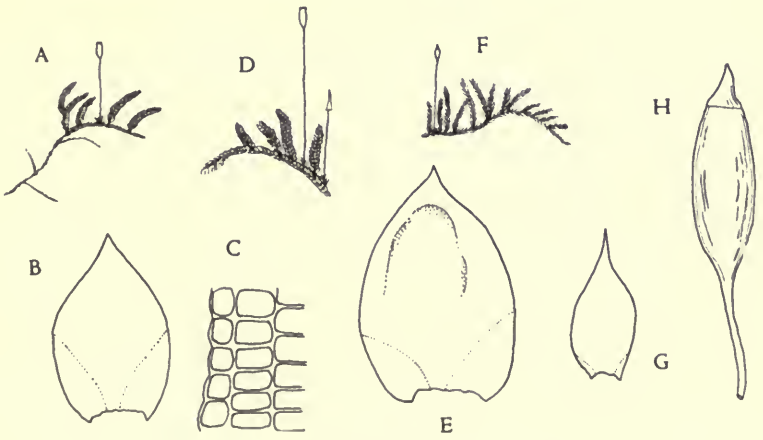

FIGURE 161

A–C, *Erythrodontium squarrosum:* A, plant, ×1; B, leaf, ×24; C, basal leaf cells and margin, ×270.

D–E, *Erythrodontium longisetum:* D, plant, ×1; E, leaf, ×24.

F–H, *Erythrodontium densum:* F, plant, ×1; G, leaf, ×24; H, capsule, ×12.

2. ERYTHRODONTIUM LONGISETUM (Hook.) Par., Ind. Bryol. Ed. 2, **2**: 158. 1904.

Neckera longiseta Hook., Musc. Exot. tab. 43. 1818.

Erythrodontium cylindricaule C. M., Bull. Herb. Boiss. **5**: 208. 1897.

Autoicous; plants yellowish green; stems elongate, interwoven, irregularly pinnate, branches rigid, julaceous. Leaves imbricated; branch leaves 1–1.5 mm. long, 0.8 mm. wide, broadly oblong-ovate, abruptly short acuminate, concave, minutely denticulate above; costa lacking or short and double; cells linear, transversely oblong in numerous rows at basal angles. Inner perichaetial leaves erect, 3–4 mm. long, subulate-acuminate; seta yellow, 1.5–2.5 cm. long; capsule oblong-cylindric, urn to 3 mm. long; peristome teeth pale, 0.25 mm. long, not divided above, faintly striolate toward base; lid 1 mm. long; spores brown, diameter 20–30 μ. (Fig. 161, D–E.)

Dept. Huehuetenango: *Standley 82776, 82867a.* Dept. Sacatepequez: *Standley 63073.* Dept. Chimaltenango: *Standley 80320a.*

Distribution: Mexico, Central and South America.

On tree trunks at medium altitudes. The plants are somewhat coarser than *E. squarrosum*, paler green and readily separated by the yellow setae.

3. ERYTHRODONTIUM DENSUM (Hook.) Par., Ind. Bryol. Ed. 2, **2**: 158. 1904.

Leskea densa Hook., Kunth, Pl. Aequin. **1**: 61. 1822.

Dioicous; plants slender, yellowish green, in lax mats; stems creeping or arched, branches ascending, subterete, often slenderly attenuate, freely rebranched. Leaves appressed when dry, erect-spreading when moist, to 1 mm. long, ovate-lanceolate, gradually acuminate, concave, minutely denticulate above; costa very short and double; cells linear, transversely oblong in 5–6 rows at basal angles. Seta 9–12 mm. long, reddish; capsule erect, narrowly oblong, urn 1.8 mm. long; peristome teeth pale brown, transversely striolate below, segments filiform, shorter than teeth; lid 0.5 mm. long, obliquely conic-rostrate; spores about 15 μ. (Fig. 161, F–H.)

Dept. Huehuetenango: *Standley 82279.* Dept. Quezaltenango: *Standley 83644, 86132.* Dept. Sacatepequez: *Standley 59831* in part, *61230a* in part. Dept. Chimaltenango: *Standley 57929a, 80038, 80052.* Dept. Jalapa: *Steyermark 33118.*

Distribution: Mexico, Costa Rica, South America.

On tree trunks and logs at moderate altitudes. The very slender habit and relatively long acuminate leaves with the characteristic oblate alar cells will distinguish this species.

4. ERYTHRODONTIUM PRINGLEI Card., Rev. Bryol. **37**: 11. 1910.

Dioicous; plants golden brown; stems to 4 cm. long, irregularly branched, branches julaceous, flexuous. Leaves closely imbricated, 1.5 mm. long, 0.9 mm. wide, broadly ovate, concave, abruptly acuminate; margins subentire, often narrowly reflexed toward apex; costa short, double; cells linear, transversely rectangular in 6–8 rows at basal angles. Seta reddish, 15–18 mm. long; capsule erect, cylindric; lid obliquely conic-rostrate. (Fig. 162, A–B.)

Dept. Huehuetenango: *Standley 82905*.

Distribution: Mexico.

On damp bank at moderate altitude. More robust than *E. densum*, with larger, more abruptly acuminate leaves.

2. PTERIGYNANDRUM Hedw., Sp. Musc. 80. 1801.

Dioicous; small plants in thin mats; stems creeping, branches ascending, attenuate. Leaves small, imbricated or secund, usually papillose on back; costa short and double; cells linear, quadrate at basal angles. Seta slender; capsules erect; peristome double, segments short; lid conic-rostrate.

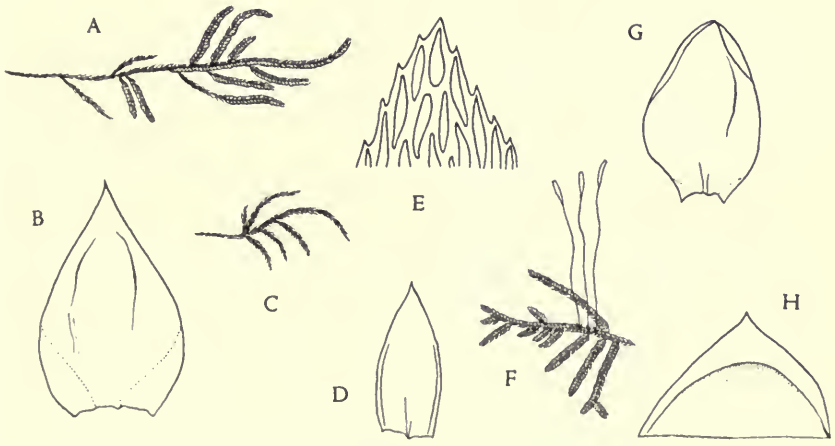

FIGURE 162

A–B, *Erythrodontium Pringlei:* A, plant, ×1; B, leaf, ×24.

C–E, *Pterigynandrum filiforme* var. *mexicanum:* C, plant, ×1; D, leaf, ×24; E, apex of leaf, ×270.

F–H, *Entodon erythropus:* F, plant, ×1; G, leaf, ×16; H, apex of leaf, ×68.

1. PTERIGYNANDRUM FILIFORME Hedw. var. MEXICANUM Thér., Smiths. Misc. Coll. **85**[4]: 41. 1931.

Plants yellowish; stems 2–3 cm. long, branches irregular, curved, freely rebranched. Leaves noticeably secund, 0.8 mm. long, to 0.5 mm. wide, oblong-ovate, concave, short acuminate, denticulate above; costa double, often extending about ⅓ up; cells linear, slightly papillose at apical angles on back above, quadrate alar cells few. Sporophyte not seen. (Fig. 162, C–E.)

Dept. San Marcos: *Steyermark 35686, 35858a; Standley 85399.*

Distribution: Mexico.

On rocks at high altitudes. The curved branchlets with the leaves plainly secund, especially when dry, are quite characteristic.

3. ENTODON C. M., Linnaea **18**: 704. 1844.

Plants glossy, in extensive mats; stems creeping, subpinnate, complanate-foliate. Leaves ovate, subentire; costa short and double or none; cells linear, smooth, subquadrate in a conspicuous alar group. Seta elongate, smooth; capsules erect, cylindric; lid conical; peristome double, teeth often striolate, segments narrow from a low basal membrane.

1. Seta red ..... 1. *E. erythropus*
   Seta yellow 2
2. Segments of endostome vertically striolate ..... 2. *E. macropodus*
   Segments of endostome papillose 3
3. Leaves acuminate, peristome teeth transversely striolate below, vertically striolate above ..... 3. *E. Jamesoni*
   Leaves bluntly acute, peristome teeth vertically striolate below, minutely papillose above ..... 4. *E. Hampeanus*

1. ENTODON ERYTHROPUS Mitt., Journ. Linn. Soc. **12**: 525. 1869.

?Entodon Bernoullii Hampe, Bull. Herb. Boiss. **5**: 209. 1897.

Autoicous; plants glossy, brownish green, in lax mats; stems creeping or arched, pinnate, branches julaceous. Leaves crowded, imbricated, slightly if at all complanate, 1.5 mm. long, 1 mm. wide, broadly ovate, acute, deeply concave, serrulate above; costa short; cells linear, shorter at apex, quadrate alar cells numerous in 6–8 rows. Seta red, 2 cm. long; capsule cylindric, erect or slightly arcuate, 3–4 mm. long; lid conic-rostrate, 1 mm. long; peristome teeth pale brown, papillose, 0.3 mm. long, segments shorter than teeth. (Fig. 162, F–H.)

Dept. Huehuetenango: *Standley 81165a, 81565* (as *E. Beyrichii*), *81739a* (as *E. Beyrichii*), *82999* (as *E. Beyrichii*). Dept. Chimaltenango: *Standley 64476* (as *E. Beyrichii*). Dept. Zacapa: *Steyermark 42458.*

Distribution: Mexico, Costa Rica, South America.

On trees, rocks and banks at medium to high altitudes. I have not seen the type of *E. Bernoullii* Hampe but the description suggests that it may belong either here or to *E. Beyrichii* (Schwaegr.) C. M.

2. ENTODON MACROPODUS (Hedw.) C. M., Linnaea **18**: 707. 1844.

Neckera macropoda Hedw., Sp. Musc. 207. 1801.

Cylindrothecium Drummondii Bry. Eur. fasc. 46/47. 1851.

Autoicous; robust pale green, glossy plants in extensive, thin, flat mats. Stems elongate, creeping, branched, branches complanate-foliate, slightly hooked at tips. Leaves 1.5–2 mm. long, ovate, bluntly acute, concave, contracted at insertion; margins erect, entire except at the minutely serrulate apex; costa short, double; cells linear, chlorophyllose, alar cells numerous, short rectangular, pale. Seta slender, yellow, to 3 cm. long; capsule erect, cylindrical, urn to 4 mm. long; peristome teeth to 0.5 mm. long, vertically striolate, pale brown, segments of endostome from a low basal membrane, brown, as long as teeth, vertically striolate; lid conic-rostrate, bluntly pointed; 1.5 mm. long; spores pale, diameter 10 μ. (Fig. 163, A–C.)

Dept. El Quiche: *Sharp 5327a.*

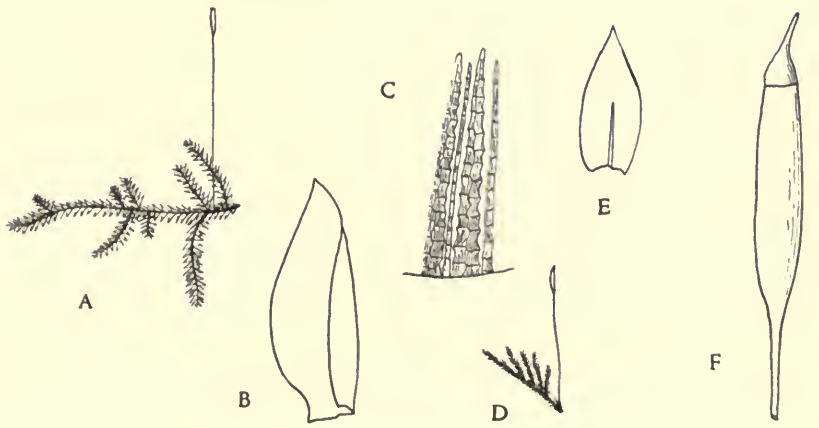

FIGURE 163

A–C, *Entodon macropodus:* A, plant, ×1; B, leaf, ×18; C, part of peristome, ×58.

D–F, *Rozea viridis:* D, plant, ×1; E, leaf, ×18; F, capsule, ×10.

Distribution: Eastern United States north to Tennessee and North Carolina, Mexico, West Indies, South America.

On log at moderately low altitude. *E. Drummondii* (Bry. Eur.) Jaeg. is surely a synonym of *E. macropodus* Hedw. The leaves and peristome structure are exactly the same. Grout (Moss Fl. of N. A., Vol. 3, p. 170) gives 0.25 mm. as the length of the peristome teeth. This is much too short. In Sull. & Lesq. Musc. Bor. Am. Ed. 2, No. 390 the peristome teeth are 0.5 mm. long and in tropical regions even longer.

3. ENTODON JAMESONI (Tayl.) Mitt., Journ. Linn. Soc. **12**: 528. 1869.

Pterogonium Jamesoni Tayl., Hook. Lond. Journ. Bot. **5**: 59. 1846.
Entodon serrulatus Mitt., Journ. Linn. Soc. **12**: 632. 1869.
?Entodon flaviusculus C. M., Bull. Herb. Boiss. **5**: 209. 1897.

Autoicous; plants yellowish green; stems creeping, irregularly pinnate, 2–3 cm. long, complanate-foliate, branches attenuate. Leaves ovate-lanceolate, acuminate, 1–1.5 mm. long, slightly secund when dry, concave; margins slightly recurved below, serrulate above; costa double, short; cells linear, quadrate alar cells numerous. Seta 6–8 mm. long, yellow; capsule cylindric, urn 3 mm. long; peristome teeth reddish brown, cleft at tips, transversely striolate below, vertically striolate above, segments nearly as long as teeth, narrow, papillose; spores 20–25 μ. (Fig. 164, A–C.)

Dept. San Marcos: *Standley 66278, 66312, 68594, 85291.* Dept. Quezaltenango: *Standley 66350b, 67640, 67660, 83554a, 84331, 84337, 85989; Steyermark 33251, 34087, 34093b; Godman & Salvin* (type of *E. serrulatus* Mitt.).

Distribution: Mexico, Central and South America.

On tree trunks and damp banks at high altitudes. The distinctions between *E. serrulatus* Mitt. and *E. Jamesoni* are too subtle for my eyes. Until the tropical American species are carefully restudied it seems useless to labor the question of specific identities. No material of *E. flaviusculus* C. M. is available but the description suggests that it may belong here.

4. ENTODON HAMPEANUS C. M., Linnaea **18**: 705. 1844.

Autoicous; plants yellowish green, coarser than *E. Jamesoni* and more hooked at the tips of the stems and branches. Leaves to 2 mm. long, oblong-ovate, acute, minutely denticulate above; quadrate alar cells numerous, often in a larger area on one side than on the

other. Seta 14–16 mm. long, yellow; capsule cylindric, urn 2.5 mm. long, tapering below; peristome teeth vertically striolate below, smooth or minutely papillose above; spores 14–18 μ. (Fig. 164, D–F.)

Dept. Escuintla: *Standley 64880.*

Distribution: Mexico, West Indies, Central and South America.

On boulder at rather low altitude. The bluntly pointed leaves and the different peristome teeth are distinctive in comparison with *E. Jamesoni.*

4. ROZEA Besch., Prodr. Bryol. Mex. 97. 1871.

Plants golden brown, glossy, in dense mats; stems creeping, branches numerous, ascending, densely foliate, julaceous. Leaves closely imbricated, often slightly secund, oblong-lanceolate, concave, short pointed; margins recurved, serrulate at apex; costa single, to above mid-leaf; cells linear, smooth, more lax at base, quadrate at basal angles. Seta elongate; capsules erect, cylindric; peristome double, teeth transversely striolate; lid conical.

Plants golden brown, spores 22–30 μ in diameter.....1. *R. Bourgaeana*
Plants yellowish green, spores 10–16 μ in diameter.....2. *R. viridis*

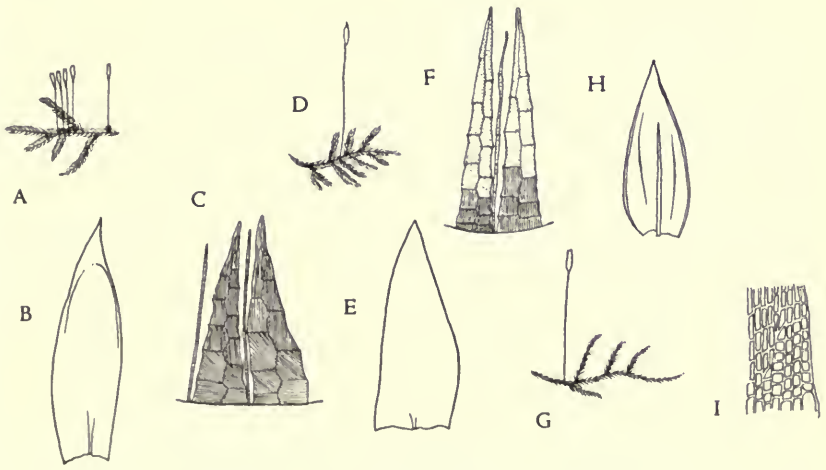

FIGURE 164

A–C, *Entodon Jamesoni:* A, plant, ×1; B, leaf, ×20; C, part of peristome, ×110.

D–F, *Entodon Hampeanus:* D, plant, ×1; E, leaf, ×20; F, part of peristome, ×110.

G–I, *Rozea Bourgaeana:* G, plant, ×1; H, leaf, ×22; I, basal angle of leaf, ×110.

1. ROZEA BOURGAEANA Besch., Prodr. Bryol. Mex. 98. 1871.

Stems 2–3 cm. long, densely branched, branches curved, varying from quite slender to moderately robust. Leaves crowded, homomallous when dry, erect-spreading when moist, to 1 mm. long, 0.4 mm. wide, oblong-lanceolate, short acuminate, concave, biplicate; margins recurved nearly all around, denticulate near apex; costa ending well above mid-leaf; cells linear, more lax at extreme base, quadrate at basal angles and across insertion. Seta slender, red, 10–15 mm. long; capsule cylindric, urn 2.5–3 mm. long; peristome teeth pale brown, segments nearly as long as teeth, from a low basal membrane; spores 22–30 μ in diameter. (Fig. 164, G–I.)

Dept. Huehuetenango: *Steyermark 48475, 49925, 50056; Standley 62654, 81729, 81767, 81804b.* Dept. San Marcos: *Steyermark 35888.* Dept. Totonicapan: *Standley 83094.* Dept. Quezaltenango: *Steyermark 34723a, 34727; Standley 67705, 83554.* Dept. Solola: *Steyermark 47013.* Dept. Chimaltenango: *Standley 58707, 60068a.*

Distribution: Mexico.

On trees, logs, banks and limestone boulders at high altitudes. Many of the collections are sterile but the fertile ones show the spores about 25 μ in diameter on the average, so I have tentatively referred them all to *R. Bourgaeana*, as some of the Mexican species seem to be rather dubiously distinct.

2. ROZEA VIRIDIS Besch., Prod. Bryol. Mex. 99. 1871.

Plants similar to *R. Bourgaeana* but slightly more slender, pale yellowish green less strongly tinged with brown. Stems filiform, creeping, branches suberect, curved and julaceous when dry. Leaves slightly secund, to 1 mm. long, ovate, short acuminate, concave, lightly plicate; margins revolute to apex, denticulate above; costa ending near mid-leaf; cells linear-rhomboidal, shorter and subquadrate near insertion and at basal angles. Seta red, 15 mm. long; capsule erect, cylindrical; peristome as in *R. Bourgaeana;* spores 10–16 μ in diameter. (Fig. 163, D–F.)

Dept. Quezaltenango: *Sharp 2110, 2114b.*

Distribution: Mexico.

On *Cupressus* logs at moderately high altitudes. In these collections the spores measure only 10–16 μ in diameter as compared with about 25 μ in *R. Bourgaeana.* The plants are yellowish in color and may be referable to *R. chrysea* Besch. but pending a critical study of the Mexican species I find it impossible to apply the names with much satisfaction.

44. PLAGIOTHECIACEAE

Slender to rather robust, mostly glossy plants; stems creeping, irregularly branched, complanate-foliate. Leaves often asymmetrical, usually acuminate; costa single and well developed or short and double; cells linear or rhomboidal, differentiated alar cells numerous or none. Seta elongate, smooth; capsules erect or nodding; peristome double, endostome with or without cilia; lid conical to conic-rostrate.

1. Costa single....2
   Costa double and short or none....3
2. Capsules inclined or horizontal, endostome with a high basal membrane....1. *Stereophyllum*
   Capsules erect, endostome with a low basal membrane....2. *Entodontopsis*
3. Quadrate alar cells numerous....3. *Pilosium*
   Quadrate alar cells few or none....4
4. Leaves distichous-complanate, widely spreading....4. *Plagiothecium*
   Leaves complanate, usually erect-spreading....5. *Isopterygium*

1. STEREOPHYLLUM Mitt., Musc. Ind. Or. 117. 1859.

Plants slender or relatively robust; stems creeping, radiculose on under side, irregularly branched. Leaves crowded, often homomallous, short pointed, rarely acuminate; costa single, ending near mid-leaf; cells rhomboidal or linear, smooth or unipapillate, subquadrate in numerous rows at basal angles. Seta elongate; capsules nodding, ovoid, contracted under mouth when dry; peristome complete; lid conical.

1. Leaves acuminate....3. *S. leucostegium*
   Leaves obtuse or broadly acute....2
2. Leaf cells broadly rhomboidal....1. *S. radiculosum*
   Leaf cells linear....2. *S. subobtusum*

1. STEREOPHYLLUM RADICULOSUM (Hook.) Mitt., Journ. Linn. Soc. **12**: 542. 1869.

   Hookeria radiculosa Hook., Musc. Exot. tab. 51. 1818.
   ?Stereophyllum affixum C. M., Bull. Herb. Boiss. 5: 217. 1897.

Autoicous; plants rather robust, in yellowish green mats; stems 1–3 cm. long, sparingly branched, complanate-foliate, 3–4 mm. wide. Leaves crowded, to 2 mm. long, oblong-ovate, broadly acute, denticulate near apex; costa strong, extending about ⅔ up; cells oval-rhomboidal, rather incrassate, smooth or faintly unipapillate, shorter at base, rounded-quadrate in numerous rows at basal angles. Seta

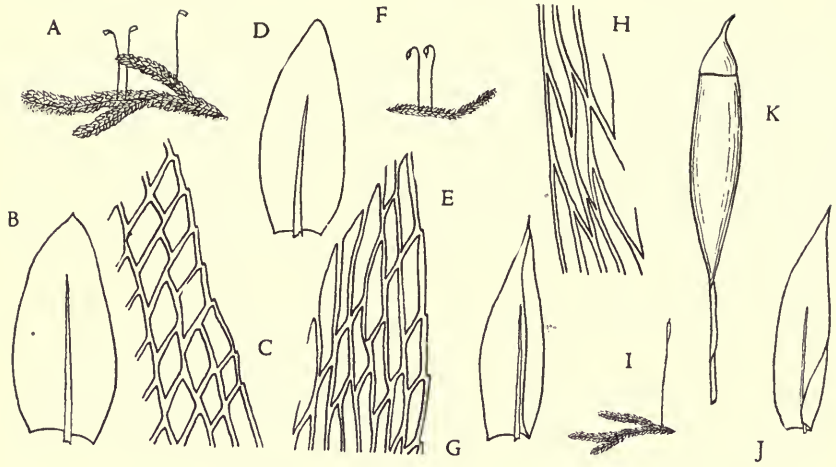

FIGURE 165

A–C, *Stereophyllum radiculosum:* A, plant, ×1; B, leaf, ×16; C, upper leaf cells and margin, ×270.

D–E, *Stereophyllum subobtusum:* D, leaf, ×16; E, upper leaf cells and margin, ×270.

F–H, *Stereophyllum leucostegium:* F, plant, ×1; G, leaf, ×16; H, upper leaf cells and margin, ×270.

I–K, *Entodontopsis contorte-operculata:* I, plant, ×1; J, leaf, ×16; K, capsule, ×8.

slender, 10–12 mm. long; capsule ovoid, inclined, urn 1–1.5 mm. long; lid conic-rostrate. (Fig. 165, A–C.)

Dept. Peten: *Lundell 2058, 2823.* Dept. Santa Rosa: *Standley 78423.*

Distribution: Florida, Texas, Mexico, Costa Rica, West Indies, South America.

On tree trunks and wet rocks at rather low altitudes. This species will probably acquire a considerable synonymy. The presence or absence of papillae on the leaf cells is not a stable character as both smooth and papillose cells occur on the same plant. Steere's remarks on this matter (Am. Journ. Bot. **22**[3]: 407. 1935 and Rev. Bryol. et Lichen **7**: 39. 1934) are very much to the point.

2. STEREOPHYLLUM SUBOBTUSUM Ren. & Card., Bull. Soc. Roy. Bot. Belg. **41**: 147. 1903.

Autoicous; plants yellowish green, similar in habit and general appearance to *S. radiculosum.* Leaves 1–2 mm. long, lingulate, obtuse, minutely denticulate near apex, entire below; costa strong, extending to above mid-leaf; cells linear, 5–7 μ wide and 35–50 μ

long, smooth or occasionally faintly unipapillate, shorter and rhomboidal at extreme apex, subquadrate in numerous rows at basal angles extending nearly or quite to the costa. Seta slender, smooth, 8–12 or 15 mm. long; capsule ovoid, inclined. (Fig. 165, D–E.)

Dept. Sacatepequez: *Standley 88961d.* Dept. Santa Rosa: *Standley 78188a* (as *S. radiculosum*).

Distribution: Mexico, Costa Rica.

On tree trunks at moderately low altitudes. Scarcely separable from *S. radiculosum* except under the microscope when the linear leaf cells are at once distinctive as compared with the short, broadly rhomboidal cells of *S. radiculosum.*

3. STEREOPHYLLUM LEUCOSTEGIUM (Brid.) Mitt., Journ. Linn. Soc. **12**: 543. 1869.

Leskea leucostega Brid., Bry. Univ. **2**: 333. 1827.

Stereophyllum pycnoblastum C. M., Bull. Herb. Boiss. **5**: 217. 1897.

Autoicous; plants rather slender, bright green, glossy, in lax mats; stems 1–2 cm. long. Leaves laxly imbricated, homomallous, to 1.5 mm. long, ovate-lanceolate, acuminate, entire, concave; costa slender, extending to or slightly above mid-leaf; cells linear, smooth, alar cells quadrate, numerous, extending to costa. Seta slender, 8–10 mm. long; capsule ovoid, nodding, urn 1 mm. long; lid conical, 0.4 mm. long. (Fig. 165, F–H.)

Dept. Sacatepequez: *Standley 63197.* Dept. Chiquimula: *Standley 74287.* Dept. Santa Rosa: *Standley 77968.*

Distribution: Florida, Mexico, Costa Rica, West Indies, South America.

On tree trunks and shaded rocks at rather low altitudes. From the description *S. pycnoblastum* clearly belongs here and I doubt if *S. Orcuttii* Card. of Mexico is specifically distinct.

2. ENTODONTOPSIS Broth., E. & P. Pflanzenf. 1^3: 895. 1907.

Autoicous; plants slender, similar in most respects to *Stereophyllum* but capsules erect, narrowly cylindrical; peristome double, segments of endostome from a low basal membrane.

1. ENTODONTOPSIS CONTORTE-OPERCULATA (C. M.) Broth., E. & P. Pflanzenf. 1^3: 896. 1907.

Hypnum contorte-operculatum C. M., Syn. **2**: 682. 1851.

Plants pale green, in thin mats; stems 1–2 cm. long, sparingly branched, complanate-foliate. Leaves about 1.5 mm. long, ovate-lanceolate, short acuminate, entire; costa slender, ending near or just above mid-leaf; cells linear, smooth, laxly short rectangular or quadrate and hyaline at basal angles and across insertion. Seta slender, 10–15 mm. long; capsule erect, narrowly cylindrical, urn 2 mm. long; lid obliquely beaked, nearly 1 mm. long. (Fig. 165, I–K.)

Dept. Santa Rosa: *Standley 78142*.

Distribution: Costa Rica.

On rotten wood at rather low altitude. This genus appears to be a weak segregate from Stereophyllum as *S. anceps* of the Himalayas and Malaysia has erect capsules that are nearly as cylindrical.

3. PILOSIUM C. M., Flora **83**: 339. 1897.

Autoicous; plants glossy, bright green, in thin mats; stems elongate, radiculose on under side, irregularly branched, complanate-foliate. Lateral leaves larger, asymmetrical, short pointed, ecostate, entire; cells linear, oblong, hyaline or colored at basal angles. Sporophyte as in Stereophyllum.

1. PILOSIUM CHLOROPHYLLUM (Hornsch.) C. M., Flora **83**: 340. 1897.

Hypnum chlorophyllum Hornsch., Fl. Bras. 1[2]: 89. 1840.
Pilosium longisetulum C. M., Flora **83**: 340. 1897.

Stems to 3–4 cm. long, 4–5 mm. wide. Lateral leaves widely spreading with deflexed points, to 2.5 mm. long, 1 mm. wide, oblong-ovate, short acuminate, entire, broadly inflexed on one side below; dorsal leaves slightly smaller, erect-appressed, more symmetrical; costa lacking; cells linear, smooth, shorter at apex and extreme base, laxly oblong, hyaline or brownish at basal angles. Seta very slender, 15 mm. long; capsule small, oblong, urn 0.5 mm. long; lid 0.25 mm. long, with a short, oblique beak. (Fig. 166, A–C.)

Distribution: Costa Rica, Panama.

On logs and trees. I have seen no collection from Guatemala but the species is frequent in Costa Rica at low altitudes. The ecostate, strongly asymmetrical lateral leaves with numerous oblong alar cells, usually in a larger, colored area on one side than on the other, makes this species easy to recognize.

4. PLAGIOTHECIUM Bry. Eur. fasc. 48. 1851.

Plants glossy, growing in lax mats; stems creeping, irregularly branched, very complanate-foliate. Leaves appearing distichous, lateral rows often asymmetrical; costa lacking or short and double; cells linear, smooth, not or slightly differentiated at basal angles. Seta elongate, smooth; capsules oblong-cylindric, nodding; peristome complete.

1. Leaves ligulate, acute or obtuse ..... 4. *P. scalpellifolium*
   Leaves ovate, acuminate 2
2. Leaves denticulate all around ..... 3. *P. planissimum*
   Leaves entire or toothed at apex only 3
3. Leaves entire ..... 2. *P. denticulatum*
   Leaves serrulate toward apex ..... 1. *P. Standleyi*

1. PLAGIOTHECIUM STANDLEYI Bartr., Bryol. **49**: 121. 1946.

Dioicous; yellowish, glossy plants in flat mats; stems creeping, irregularly branched, branches to 3 cm. long, complanate-foliate. Leaves not crowded, widely spreading and arcuate with decurved points when dry, ovate, short acuminate, asymmetrical, decurrent,

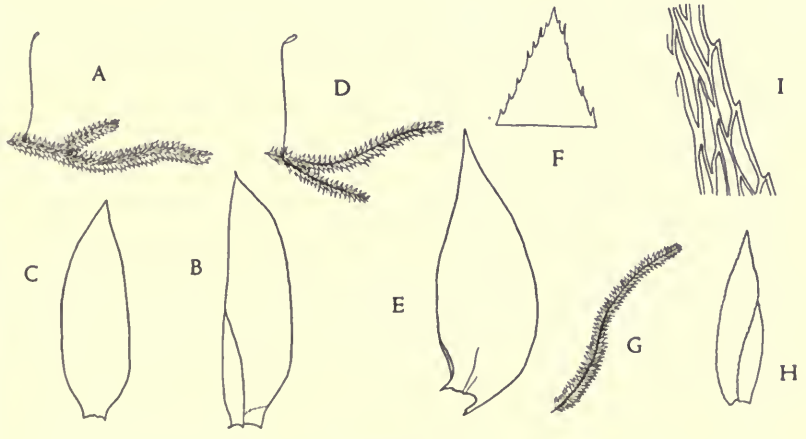

FIGURE 166

A–C, *Pilosium chlorophyllum:* A, plant, ×1; B, lateral leaf, ×16; C, median leaf, ×16.

D–F, *Plagiothecium Standleyi:* D, plant, ×1; E, leaf, ×16; F, apex of leaf, ×110.

G–I, *Plagiothecium planissimum:* G, plant, ×1; H, leaf, ×16; I, upper leaf cells and margin, ×270.

often filamentose at apex, to 2 mm. long, 1 mm. wide; margins slightly reflexed below, plane above, sharply serrulate toward apex; costa double and short; cells linear, smooth, lax and subrectangular near insertion. Seta 15–20 mm. long, pale; capsule inclined, striate when dry, urn cylindrical, 1.5 mm. long, with a distinct neck; peristome pale. (Fig. 166, D–F.)

Dept. Quezaltenango: Volcan Santa Maria, alt. 3,150 m., *Standley 67646* TYPE; *Steyermark 34081, 34115.*

Endemic.

On trees and moist bank. Near *P. sylvaticum* (Brid.) but the leaves sharply toothed near apex and often filamentose at the tips. *P. longisetulum* C. M. seems to be widely different and is described as having narrowly oblong, entire leaves.

2. PLAGIOTHECIUM DENTICULATUM (Hedw.) Bry. Eur. fasc. 48. 1851.

Hypnum denticulatum Hedw., Sp. Musc. 237. 1801.

Autoicous; robust plants, yellowish green, glossy, in dense mats. Stems prostrate, branched, complanate-foliate. Leaves widely spreading both moist and dry, slightly undulate when dry, to 3 mm. long, 1 mm. wide, ovate-lanceolate, lightly concave, decurrent, slightly asymmetrical, acuminate, entire; costa short, double; cells linear, shorter at apex and near insertion. Seta slender, reddish, to 18 mm. long; capsule cylindrical, urn 2.5 mm. long with neck; peristome pale. (Fig. 167, A–B.)

Dept. Totonicapan: *Sharp 2607.*

Distribution: Northern United States and Canada south to Georgia and Colorado.

On stump at high altitude. A robust form with leaves 3 mm. or slightly more long, slenderly acuminate and often faintly undulate toward tips. These plants are in good fruit and appear autoicous so I have referred them here rather than to *P. sylvaticum* (Brid.) Bry. Eur.

3. PLAGIOTHECIUM PLANISSIMUM (Mitt.) Bartr., Bryol. **49**: 122. 1946.

Isopterygium planissimum Mitt., Journ. Linn. Soc. **12**: 498. 1869.

Dioicous; plants yellowish green with a vitreous sheen, growing in intricate mats. Stems 2–6 cm. long, to 3 mm. wide, occasionally

with minute, sharply toothed paraphyllia in the leaf axils. Leaves close, widely spreading in 2 rows, to 1.5 mm. long, ovate-lanceolate, acuminate; margins plane or narrowly recurved near base, serrulate all around; costa faint, short and double; cells narrowly linear, smooth or very faintly papillose at apical angles, shorter at apex, short and oblong in a very small, hardly noticeable group at basal angles. Sporophyte not seen. (Fig. 166, G–I.)

Dept. Alta Verapaz: *Steyermark 45564*. Dept. Quezaltenango: *Standley 67279* (as *P. deplanatum*). Dept. Retalhuleu: *Standley 87193, 87209, 87213*. Dept. Sacatepequez: *Standley 60768* (as *P. deplanatum*), *66898*. Dept. Chimaltenango: *Standley 62310* (as *P. deplanatum*). Dept. Zacapa: *Steyermark 29413*.

Distribution: Mexico, West Indies, Central and South America.

On rocks and wet banks at low to medium altitudes. As a rule the plants have a characteristic glossy sheen which in addition to the distichous arrangement of the leaves makes them fairly easy of recognition.

4. PLAGIOTHECIUM SCALPELLIFOLIUM (C. M.) Bartr., Bryol. **49**: 122. 1946.

Microthamnium scalpellifolium C. M., Bull. Herb. Boiss. **5**: 214. 1897.

Dioicous; plants yellowish green, glossy, in intricate mats; stems prostrate, 1–2 cm. long, freely branched, branches short, 2 mm.

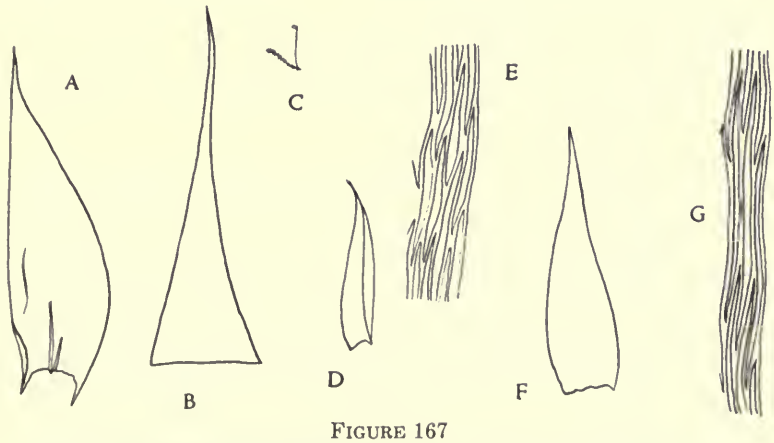

FIGURE 167

A–B, *Plagiothecium denticulatum:* A, leaf, ×14; B, apex of leaf, ×134.

C–E, *Isopterygium diminutivum:* C, plant, ×1; D, leaf, ×38; E, upper leaf cells and margin, ×338.

F–G, *Isopterygium Chrismari:* F, leaf, ×38; G, upper leaf cells and margin, ×338.

wide, strongly complanate-foliate. Branch leaves widely spreading in 2 rows, appearing distichous, with minute linear paraphyllia in the axils, 1–1.2 mm. long, narrowly oblong or ligulate, deeply concave, abruptly acute; margins erect, minutely denticulate all around; costa double, often extending ¼ up; cells linear, smooth, shorter in apex, alar cells not differentiated. Seta short, slender; capsule minute, nodding, narrowly oblong; lid obliquely beaked (sporophyte not seen). (Fig. 168, A–C.)

Dept. Retalhuleu: *Standley 88157, 88230.* Dept. Sacatepequez: *Standley 66896.* Dept. Santa Rosa: *Standley 78370, 79399.* Mazatenango: *Bernoulli & Cario 82.*

Distribution: Honduras, Nicaragua.

On damp rocks, tree trunks and moist banks at low altitudes. A very individual species known at once by the ligulate, cymbiform, short pointed, distichous branch leaves. The stem leaves are minute, triangular-ovate and squarrose-spreading, differing sharply from the branch leaves.

Taxiphyllum seems to me to be one of the weakest segregates of the *Hypnum* complex and I feel that the species referred here may be included in *Plagiothecium* for the time being at least.

EXCLUDED SPECIES

PLAGIOTHECIUM LONGISETULUM C. M., Bull. Herb. Boiss. **5**: 212. 1897.

This is perhaps an *Isopterygium* but I cannot place it satisfactorily from the description.

5. ISOPTERYGIUM Mitt., Journ. Linn. Soc. **12**: 21. 1869.

Plants usually slender, yellowish green, growing in intricate mats; stems irregularly branched. Leaves more or less complanate-foliate but not appearing distichous, usually erect-spreading, acuminate; costa short and double or none; cells linear, smooth, subquadrate alar cells few or none. Seta elongate, smooth; capsules small, nodding, ovoid-cylindric; lid conical or short beaked; peristome double, complete.

1. Stems robust, to 4 cm. long, leaves 2 mm. or more long.....6. *I. robusticaule*
   Stems shorter and more slender, leaves less than 1.5 mm. long.....2
2. Leaves less than 0.7 mm. long.....3
   Leaves 1–1.5 mm. long.....4

3. Leaves 0.3 mm. long, denticulate all around.....1. *I. perminutum*
Leaves 0.6–0.7 mm. long, entire.....2. *I. diminutivum*

4. Leaf cells over 100 μ long.....5. *I. Chrismari*
Leaf cells less than 100 μ long.....5

5. Leaves crowded, erect-spreading, 1.5 mm. long, quadrate alar cells in 3–4 rows 4. *I. guatemalense*
Leaves open, widely spreading, 1 mm. or less long, quadrate alar cells none 3. *I. miradoricum*

1. ISOPTERYGIUM PERMINUTUM Bartr., Bryol. **49**: 122. 1946.

Autoicous; very small, pale green, glossy plants in closely interwoven, thin patches on bark of tree. Stems slender, pinnate or bipinnate, branches widely spreading, 2–3 mm. long, laxly foliate. Leaves very minute, scarcely 0.3 mm. long, widely spreading, ovate-lanceolate, acuminate, concave, ecostate; margins erect, minutely denticulate all around; cells linear, incrassate, smooth, the marginal row shorter and rhomboidal, no differentiated alar cells. Seta 8 mm. long, smooth; capsule subpendulous, urn to 0.8 mm. long; lid short conic-rostrate, 0.4 mm. long; peristome teeth yellowish, 270 μ high, segments of endostome from a high basal membrane, as long as the teeth; spores smooth, diameter 8–10 μ. (Fig. 168, D–G.)

Dept. Izabal: Damp forested slopes and barrancos, alt. 300–900 m., *Steyermark 41877.*

Distribution: Mexico.

A very attractive little moss and one of the smallest of the genus that I have seen. To the naked eye the tufts bear a resemblance to some of the more minute species of *Thuidium.*

2. ISOPTERYGIUM DIMINUTIVUM Bartr., Journ. Wash. Acad. Sci. **18**: 581. 1928.

Autoicous; very small, delicate, yellowish green plants in thin mats. Stems creeping. Leaves complanate, ovate-lanceolate, acuminate, concave, entire, to 0.6 mm. long; costa double, very short; cells linear, to 60 μ long, short and lax across insertion, alar cells few, poorly differentiated. Seta reddish, 5–8 mm. long; capsule minute, horizontal, urn 0.5 mm. long. (Fig. 167, C–E.)

Dept. Alta Verapaz: *Sharp 2990.*

Distribution: Mexico.

On bark of shrub at low altitude. Until the tropical forms of this genus are carefully studied and clearly defined the names can

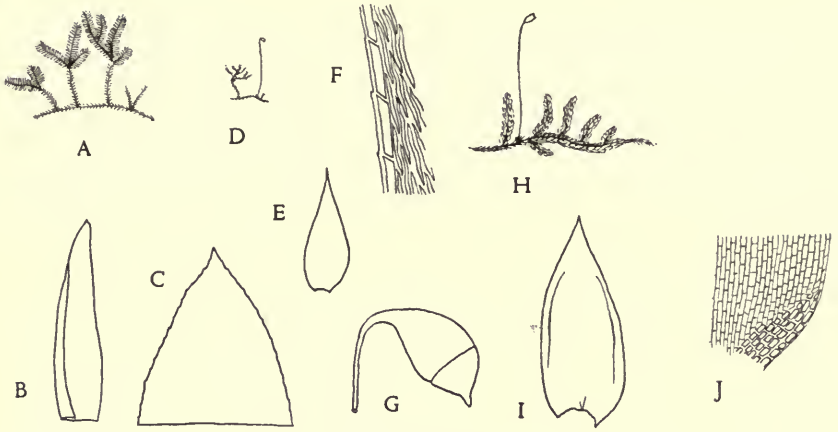

FIGURE 168

A–C, *Plagiothecium scalpellifolium:* A, plant, ×1; B, leaf, ×24; C, apex of leaf, ×110.

D–G, *Isopterygium perminutum:* D, plant, ×1; E, leaf, ×54; F, upper leaf cells and margin, ×270; G, capsule, ×16.

H–J, *Isopterygium guatemalense:* H, plant, ×1; I, leaf, ×16; J, basal angle of leaf, ×110.

only be applied with considerable reservation. This collection matches closely the type material from Mexico, so I have tentatively referred it here.

3. ISOPTERYGIUM MIRADORICUM (C. M.) Jaeg., Adumb. **2**: 502. 1876–77.

Hypnum miradoricum C. M., Linnaea **38**: 650. 1874.

?Hypnum leptomiton C. M., Linnaea **38**: 652. 1874.

Autoicous; slender, feathery plants in thin, lax, pale green mats; stems 1–1.5 cm. long, branches flexuous. Leaves not crowded, spreading, slightly contorted when dry, to 1 mm. long, ovate-lanceolate, slenderly acuminate, entire; costa lacking or very faint; cells linear, more lax near base, quadrate alar cells few and minute or lacking. Seta slender, 10–12 mm. long; capsule subpendulous, urn 1–1.5 mm. long, ovoid-cylindric; lid conical. (Fig. 169, A–C.)

Dept. Quezaltenango: *Standley 85946.*

Distribution: Mexico.

On damp bank at high altitude. Determined from the description. So many closely allied species have been described from adjacent regions that it is impossible to apply specific names with any

satisfaction. Any practical understanding of the group must await a thorough revisional study.

4. ISOPTERYGIUM GUATEMALENSE Bartr., Bryol. **49**: 123. 1946.

Pale or yellowish green, glossy plants in lax tufts; stems creeping, branching irregular to subpinnate, branches widely spreading, slightly compressed, densely foliate. Leaves laxly imbricated when dry, erect-spreading when moist, to 1.5 mm. long, 0.5 mm. wide, ovate-lanceolate, slenderly acuminate, concave; margins minutely denticulate nearly to base; costa short and double; cells narrowly linear, more lax and shorter at extreme base, subquadrate alar cells rather numerous, in 4–5 rows. Seta flexuous, dark brown; capsule inclined, short oblong, urn 1.5 mm. long, not contracted under mouth when dry. (Fig. 168, H–J.)

Dept. Chimaltenango: Between Chimaltenango and San Martin Jilotepeque, alt. 1,500–1,800 m., *Standley 64364, 80937* TYPE. Dept. Zacapa: *Steyermark 42208* (as *Plagiothecium deplanatum*).

Endemic.

On shaded banks and rocks. This species differs from *I. fecundum* Ren. & Card. of Costa Rica in the longer and more crowded leaves with a relatively larger area of quadrate alar cells in 4–5 rows (8–10 in the marginal row). *I. robusticaule* Bartr. is somewhat similar but more robust, with longer stems and larger leaves.

5. ISOPTERYGIUM CHRISMARI (C. M.) Mitt., Journ. Linn. Soc. **12**: 500. 1869.

Hypnum Chrismari C. M., Syn. **2**: 682. 1851.

Autoicous; slender, delicate plants in lax, thin mats. Stems elongate, branched, laxly foliate. Leaves complanate, 1–1.2 mm. long, ovate-lanceolate, long and finely acuminate, concave, entire; costa short, double; cells very long and narrow, to 125 μ long, 5–6 μ wide, shorter and lax near insertion, alar group small, scarcely differentiated. Seta about 2 cm. long, very slender, reddish below, paler above; capsule nodding or horizontal, urn 1 mm. long. (Fig. 167, F–G.)

Dept. Baja Verapaz: *Sharp 2903, 5161.*

Distribution: Mexico, Panama.

On moist soil at low altitudes. The unusually long and narrow leaf cells suggest this species but I am far from confident that the determination is correct.

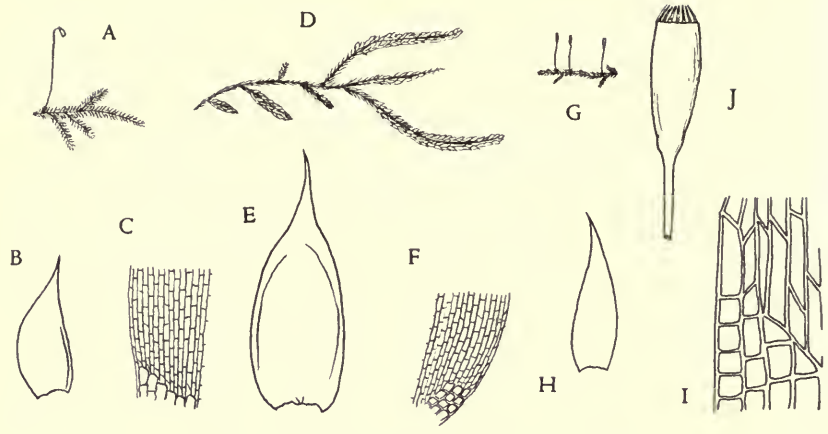

FIGURE 169

A–C, *Isopterygium miradoricum:* A, plant, ×1; B, leaf, ×16; C, basal angle of leaf, ×110.

D–F, *Isopterygium robusticaule:* D, plant, ×1; E, leaf, ×16; F, basal angle of leaf, ×110.

G–J, *Pterogonidium pulchellum:* G, plant, ×1; H, leaf, ×24; I, basal angle of leaf, ×270; J, capsule, ×16.

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6. ISOPTERYGIUM ROBUSTICAULE Bartr., Bryol. **49**: 122. 1946.

Robust, glossy, yellowish green plants in dense, intricate mats; stems creeping, to 4–5 cm. long, irregularly branched, 2–2.5 mm. wide with leaves, not or scarcely complanate-foliate. Leaves crowded, erect-spreading, 2–2.5 mm. long, ovate-lanceolate, acuminate, concave; margins minutely denticulate all around, reflexed above; costa short and double or none; cells narrowly linear, subquadrate in a small, inconspicuous group at basal angles. Fruit unknown. (Fig. 169, D–F.)

Dept. Alta Verapaz: Vicinity of Cubilguitz, alt. 300–500 m., *Steyermark 44584, 44970a*, TYPE.

Endemic.

On limestone bluffs. Possibly near *I. semicostatum* Ren. & Card. of Costa Rica but quite distinct in the broader, more concave and shorter acuminate leaves with the costa obsolete or nearly so. The longer stems and more robust habit are also distinctive.

EXCLUDED SPECIES

ISOPTERYGIUM CYLINDRICARPUM Card.=*Ctenidiadelphus cylindricarpus* (Card.) Bartr.

TAXICAULIS TRICHOPELMA C. M., Bull. Herb. Boiss. **5**: 210. 1897.

TAXICAULIS SUBSPLENDIDULUS C. M., Bull. Herb. Boiss. **5**: 210. 1897.

No material of the last two species is available and neither one can be satisfactorily located from the description.

45. SEMATOPHYLLACEAE

Plants slender or robust, often glossy, in dense tufts or mats; stems prostrate or ascending, pinnate or irregularly branched. Leaves ovate, usually acuminate; costa lacking or short and double; cells linear, smooth or papillose, large and often inflated in a conspicuous group at basal angles. Seta elongate, smooth or papillose; capsules small, nodding or horizontal, rarely erect; peristome double, complete; lid usually long and slenderly beaked; calyptra cucullate.

1. Minute plants, capsule erect, peristome single ..... 1. *Pterogonidium*
   Larger plants, capsule nodding or horizontal, peristome double 2
2. Stem and branch leaves differentiated 3
   Stem and branch leaves not differentiated 4
3. Alar cells thick walled, subquadrate ..... 2. *Heterophyllum*
   Alar cells thin walled, inflated, oblong ..... 3. *Acanthocladium*
4. Leaf cells papillose over lumens 5
   Leaf cells smooth or papillose only at apical angles 6
5. Leaf cells unipapillate ..... 7. *Trichosteleum*
   Leaf cells seriate papillose ..... 8. *Taxithelium*
6. Leaves oblong or lingulate, apex rounded or obtuse ..... 9. *Glossadelphus*
   Leaves lanceolate, acuminate 7
7. Peristome teeth with a median furrow ..... 6. *Acroporium*
   Peristome teeth with a fine, zig-zag median line 8
8. Exothecial cells rectangular, not collenchymatous ..... 5. *Brotherella*
   Exothecial cells rounded, strongly collenchymatous ..... 4. *Sematophyllum*

1. PTEROGONIDIUM C. M., Bull. Herb. Boiss. **5**: 209. 1897.

Autoicous; small yellowish green plants in thin, lax mats; stems short, irregularly branched. Leaves erect-spreading, ovate-lanceolate, ecostate; cells linear, alar cells quadrate. Seta short, smooth; capsules erect, cylindric; peristome single, teeth papillose; lid conic-rostrate.

1. PTEROGONIDIUM PULCHELLUM (Hook.) C. M., Bull. Herb. Boiss. 5: 210. 1897.

Pterogonium pulchellum Hook., Musc. Exot. tab. 4. 1818.

Pterogonidium subtilissimum C. M., Bull. Herb. Boiss. 5: 209. 1897.

Stems about 10 mm. long, prostrate, branches short, slightly complanate-foliate. Leaves not crowded, erect-spreading to widely spreading, narrowly lanceolate, acuminate, slightly concave; margins plane, minutely denticulate above; cells linear, smooth, alar cells rather numerous, quadrate, in 3–4 rows at basal angles. Seta 3–4 mm. long, yellowish; capsule cylindric, urn 1 mm. long; peristome teeth pale brown. (Fig. 169, G–J.)

Distribution: Costa Rica, West Indies, South America.

No Guatemalan collections have been seen but the description of *P. subtilissimum* certainly suggests no distinctions of any particular value. *P. nanum* (Besch.) Broth. of Guadeloupe and Martinique is without much doubt also a synonym.

2. HETEROPHYLLUM (Schimp.) Kindb., Check List Eur. & Am. Mosses 72. 1894.

Hypnum subg. *Heterophyllium* Schimp., Syn. 629. 1860.

Plants robust, golden green, glossy; stems prostrate, pinnate, paraphyllia multiform. Leaves crowded, erect-spreading to slightly secund, ovate, long acuminate, strongly serrate in our species; cells linear, alar cells subquadrate, incrassate, colored. Seta elongate, smooth; capsules oblong-cylindric, curved, nodding or suberect; lid conic-apiculate; peristome complete.

1. HETEROPHYLLUM AFFINE (Hook.) Fleisch., Laubm. Java 4: 1177. 1919.

Hypnum affine Hook., Kunth, Pl. Aequin. 1: 64. 1822–28.

Autoicous; growing in extensive mats; stems 2–6 cm. long, closely and regularly pinnate, branches often slightly hooked at tips. Stem leaves erect, appressed, complanate, 2–3 mm. long, oblong-ovate, narrowed to a long, lanceolate spinose-serrate acumen; margins plane or narrowly recurved below; costa faint or lacking; cells linear, laxer and yellowish across insertion, alar group inflated, subquadrate, in 4–5 rows, incrassate, colored. Branch leaves smaller, narrowly ovate-lanceolate. Seta 2–3 cm. long, reddish; capsule suberect, curved, urn 2.5–3 mm. long; lid apiculate. (Fig. 170, A–D.)

Dept. Huehuetenango: *Steyermark 49951, 49952.*

Distribution: Mexico, Colombia.

Ravine in alpine regions. It seems highly probable that this species is inseparable from *H. nemorosum* (Koch.) Kindb. in which event the range would extend northward to the southern Appalachians and include Europe and Asia.

3. ACANTHOCLADIUM Mitt., Trans. & Proc. Roy. Soc. Victoria **19**: 85. 1883.

Dioicous; pale, glossy plants forming dense mats or tufts. Stems prostrate or ascending, elongate, pinnate or bipinnate, branches slender, attenuate, curved when dry. Leaves erect-spreading, ovate, acuminate, entire or weakly toothed, ecostate; cells linear, colored across insertion, inflated at basal angles. Seta elongate, smooth; capsules horizontal; peristome double, perfect; lid conic-rostrate.

1. ACANTHOCLADIUM COSTARICENSE Bartr. & Dix., Journ. Wash. Acad. Sci. **21**: 294. 1931.

Slender, pale, profusely branched, glossy plants, densely tufted. Stems twice pinnate, branches spreading, ultimate branchlets

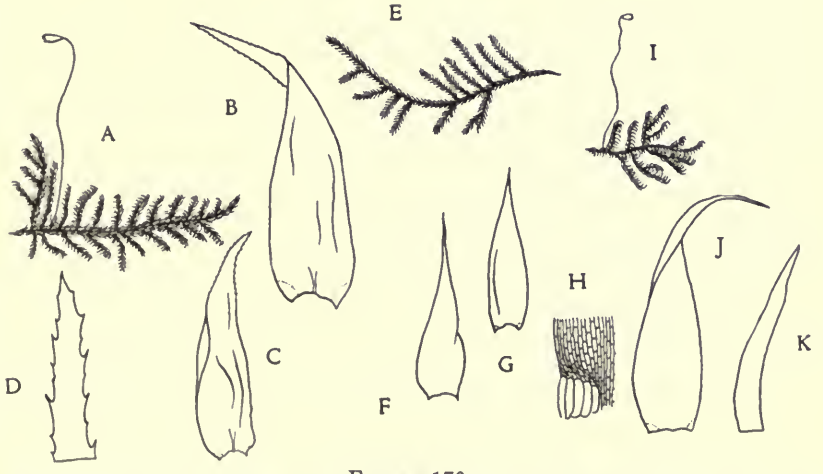

FIGURE 170

A–D, *Heterophyllum affine:* A, plant, ×1; B, stem leaf, ×16; C, branch leaf, ×16; D, apex of stem leaf, ×68.

E–H, *Sematophyllum subsimplex:* E, plant, ×1; F, stem leaf, ×16; G, branch leaf, ×16; H, basal angle of leaf, ×110.

I–K, *Sematophyllum Lindigii:* I, plant, ×1; J, leaf, ×16; K, apex of leaf, ×68.

attenuate. Stem leaves ovate, abruptly slenderly acuminate, entire, ecostate, 1.2 mm. long, 0.5 mm. wide; cells linear, to 100 μ long, colored and shorter across insertion, alar cells large, inflated, yellowish. Branch leaves smaller, lanceolate, gradually acuminate, serrulate toward apex. Fruit unknown. (Fig. 173, D–G.)

Dept. Baja Verapaz: *Sharp 2779*.

Distribution: Costa Rica.

Base of tree at moderate altitude. Apart from the more slenderly acuminate stem leaves these plants are in every way similar to the original collection from Costa Rica.

4. SEMATOPHYLLUM Mitt., Journ. Linn. Soc. 8: 5. 1865.

Autoicous; plants rather slender, often glossy, in dense mats or tufts; stems prostrate, irregularly branched, branches numerous, usually erect or ascending, densely foliate. Leaves erect-spreading or falcate, ovate-lanceolate, concave, entire or weakly toothed above, nearly ecostate; cells elongate, smooth, alar cells large, inflated, usually conspicuous. Seta smooth; capsules small, ovoid, erect or nodding, exothecial cells collenchymatous; lid subulate-rostrate; peristome complete.

1. Stems subpinnately branched, branches horizontal.....1. *S. subsimplex*
   Stems irregularly branched, branches erect or nearly so.....2
2. Leaves falcate-secund.....3
   Leaves erect-spreading.....4
3. Leaves subentire, subulate-acuminate from an oblong base.....2. *S. Lindigii*
   Leaves serrulate above, narrowly ovate-lanceolate.....3. *S. insularum*
4. Epiphytic on branches of shrubs, perichaetium 3–3.5 mm. long
   6. *S. Steyermarkii*
   Terrestrial or corticolous, perichaetium 2 mm. or less long.....5
5. Robust plants, leaves subulate-acuminate, deeply concave..4. *S. cuspidiferum*
   Plants smaller, leaves with shorter, broader points, slightly concave.....6
6. Leaf cells short, oval or rhomboidal.....5. *S. caespitosum*
   Leaf cells long and narrow.....7
7. Leaves oblong-ovate, short acuminate.....8. *S. angustirete*
   Leaves narrowly lanceolate, long acuminate.....7. *S. sericifolium*

1. SEMATOPHYLLUM SUBSIMPLEX (Hedw.) Mitt., Journ. Linn. Soc. 12: 494. 1869.

Hypnum subsimplex Hedw., Sp. Musc. 270. 1801.

Plants slender, pale, slightly glossy; stems to 3–4 cm. long, branches horizontal, usually widely spreading, somewhat com-

planate. Stem leaves erect-spreading, 1.5 mm. long, ovate, slenderly acuminate, concave, entire; cells linear, incrassate, shorter and yellow across insertion, alar cells 4–5, oblong, inflated, brownish. Branch leaves smaller, often slightly secund. Seta slender, 1.5 cm. long; capsule nodding, ovoid, urn about 1 mm. long. (Fig. 170, E–H.)

Dept. Peten: *Lundell 2727, 2824.* Dept. Izabal: *Steyermark 38833.* Dept. Alta Verapaz: *Steyermark 44421.* Dept. Solola: *Steyermark 47986.* Dept. Chiquimula: *Steyermark 31630.*

Distribution: Mexico, West Indies, Central and South America.

On logs, tree trunks and rocks at low altitudes. When well developed the spreading, horizontal branches give the species a characteristic look. The genus *Rhaphidorrhynchium* Besch. is separated from *Sematophyllum* principally by the falcate-secund leaves but the distinction seems to be of minor importance.

2. SEMATOPHYLLUM LINDIGII (Hampe) Mitt., Journ. Linn. Soc. **12**: 487. 1869.

Hypnum Lindigii Hampe, Ann. Sci. Nat. Ser. 5, **5**: 330. 1866.

Sematophyllum oblique-rostratum Mitt., Journ. Linn. Soc. **12**: 490. 1869.

Plants relatively robust, golden yellow, glossy, in dense mats; stems 2–4 cm. long, irregularly pinnate. Leaves crowded, falcate-secund, 2–2.5 mm. long, long subulate-acuminate from an oblong-ovate base, entire or nearly so; margins recurved below; alar cells conspicuous, yellow, often transversely divided. Perichaetial leaves filiform-acuminate, entire; seta bright red, 1.5–2 cm. long; capsule subhorizontal, oblong, curved, urn 1–1.5 mm. long. (Fig. 170, I–K.)

Dept. Alta Verapaz: *Standley 69063, 69088, 70363, 91457, 92070.* Dept. San Marcos: *Steyermark 36478.* Dept. Totonicapan: *Standley 84018, 84527.* Dept. Sacatepequez: *Standley 63666.* Dept. Chimaltenango: *Standley 60949, 61088, 61844.* Dept. El Progresso: *Steyermark 43437.* Dept. Jalapa: *Steyermark 32483a, 32819.*

Distribution: Mexico, Costa Rica, Colombia, Ecuador.

On logs and tree trunks at medium to high altitudes. Readily known by the robust habit and strongly falcate-secund, entire leaves. I doubt if *S. oblique-rostratum* has any distinctive characters.

3. SEMATOPHYLLUM INSULARUM (Sull.) Mitt., Journ. Linn. Soc. **12**: 489. 1869.

Hypnum insularum Sull., Proc. Am. Acad. **5**: 287. 1861.

Less robust than *S. Lindigii;* stems 1–3 cm. long, yellowish brown, paler at tips. Leaves falcate-secund, 1.5 mm. long, narrowly ovate-

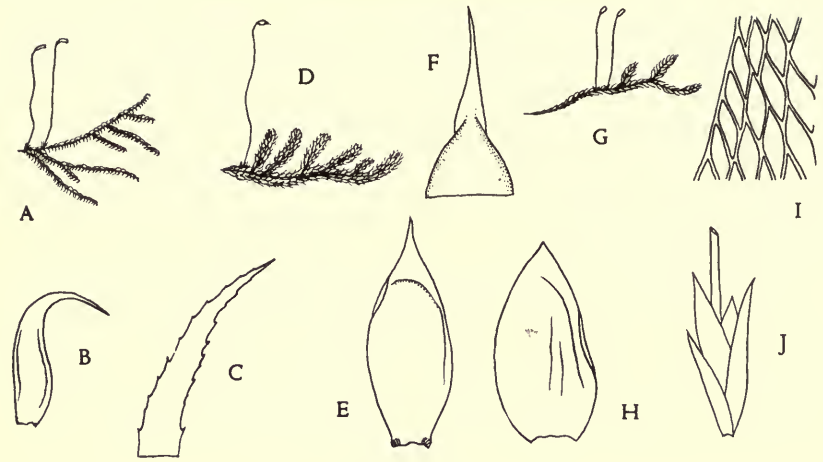

FIGURE 171

A–C, *Sematophyllum insularum:* A, plant, ×1; B, leaf, ×16; C, apex of leaf, ×110.

D–F, *Sematophyllum cuspidiferum:* D, plant, ×1; E, leaf, ×16; F, apex of leaf, dorsal view, ×32.

G–J, *Sematophyllum caespitosum:* G, plant, ×1; H, leaf, ×16; I, upper leaf cells and margin, ×270; J, perichaetium, ×10.

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lanceolate, slenderly acuminate; margins erect, minutely but distinctly serrulate toward apex; alar cells 3–4, oblong, inflated, colored. Perichaetial leaves oblong, acuminate, serrulate; seta about 1.5 cm. long, red; capsule horizontal, ovoid-cylindric, urn to 1.5 mm. long. (Fig. 171, A–C.)

Dept. Alta Verapaz: *Standley 90776.* Dept. Totonicapan: *Standley 84512b, 84556.* Dept. Quezaltenango: *Steyermark 34318, 34723b, 34865, 34873, 34874; Standley 84238.* Dept. Jalapa: *Steyermark 32531* (as *S. chrysocladon*).

Distribution: Costa Rica, Cuba, Jamaica.

On logs and tree trunks at medium to high altitudes. The much narrower leaves, serrulate above and especially at the tips will assist in separating this species from *S. Lindigii.*

4. SEMATOPHYLLUM CUSPIDIFERUM Mitt., Journ. Linn. Soc. **12**: 480. 1869.

Plants robust, brownish or golden green, glossy, in dense mats; stems to 3 or 4 cm. long, branches numerous, ascending, tumid, slightly complanate-foliate. Leaves laxly imbricated, about 2 mm. long, oblong-ovate, deeply concave, subulate-acuminate, ecostate,

entire; alar cells 3–4, oblong, supra-alar cells subquadrate. Perichaetial leaves 2–2.5 mm. long, lanceolate, long subulate-acuminate, entire; seta red, 2.5 cm. long; capsule horizontal, ovoid, urn 1 mm. long; lid subulate-rostrate, 0.5 mm. long. (Fig. 171, D–F.)

Dept. Quezaltenango: *Standley 67106, 68007, 83300, 83688, 84582, 84765, 84774, 84810, 84882, 85664, 85653a, 86796, 86834, 86863a, 87966; Steyermark 33210, 33370, 35181.*

Distribution: Costa Rica, Ecuador.

On damp banks, rocks and tree trunks at medium to rather high altitudes. Apparently confined to Quezaltenango locally and fairly distinct from any of the *caespitosum* complex by the more robust habit and the deeply concave leaves with long, subulate-acuminate points.

5. SEMATOPHYLLUM CAESPITOSUM (Hedw.) Mitt., Journ. Linn. Soc. **12**: 479. 1869.

Leskea caespitosa Hedw., Sp. Musc. 233. 1801.
Hypnum loxense Hook., Kunth Pl. Aequin. **1**: 62. 1822–28.
Hypnum galipense C. M., Bot. Zeit. **1848**: 780. 1848.

Plants yellowish green, laxly tufted; stems 1–4 cm. long, irregularly branched, branches often curved with the leaves slightly secund. Leaves crowded, 1–1.5 mm. long, oblong-ovate or ovate, acute or short acuminate, slightly concave, entire, ecostate; cells oval-rhomboidal, shorter at apex and more elongate below, alar cells 3–4, oblong, scarcely inflated, supra-alar cells subquadrate, rather numerous. Perichaetium small, inner leaves about 1.5 mm. long, ovate, broadly acuminate, entire; seta 5–15 mm. long, red; capsule inclined, ovoid, often asymmetrical, urn 1–1.5 mm. long. (Fig. 171, G–J.)

Dept. Alta Verapaz: *Standley 71736, 71760, 90363, 90679; Steyermark 44858.* Dept. Huehuetenango: *Standley 82386, 82424.* Dept. Quezaltenango: *Standley 84692, 85174, 86799, 87936; Steyermark 33209, 33673, 35119.* Dept. Sacatepequez: *Standley 88961.* Dept. Zacapa: *Steyermark 42217, 42218, 42219, 42220, 42222, 42223, 42224.* Dept. Jalapa: *Standley 77052.*

Distribution: Florida, Mexico, West Indies, Central and South America.

On tree trunks, damp banks and wet rocks at low to medium altitudes. A frequent, widely distributed, protean species which I think includes *H. loxense* and *H. galipense* without much doubt.

6. SEMATOPHYLLUM STEYERMARKII Bartr., Bryol. **49**: 123. 1946.

Autoicous; robust, glossy, yellowish green plants, epiphytic on branches of shrubs; stems elongate, creeping, adhering to the bark,

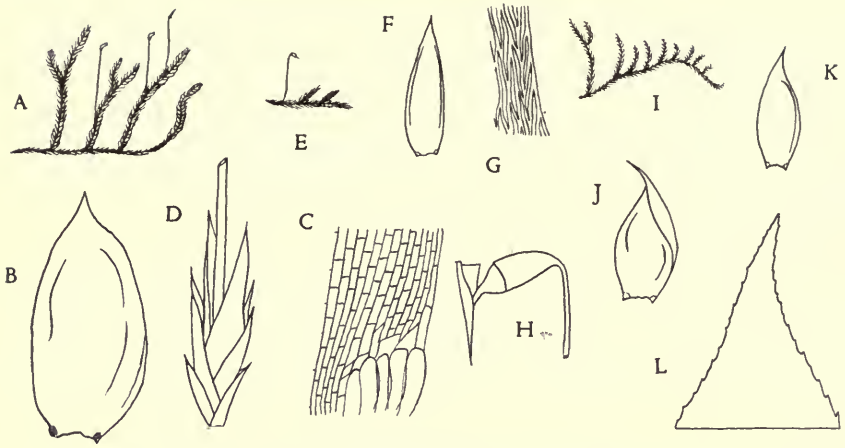

FIGURE 172

A–D, *Sematophyllum Steyermarkii:* A, plant, ×1; B, leaf, ×16; C, basal angle of leaf, ×110; D, perichaetium, ×10.

E–H, *Sematophyllum sericifolium:* E, plant, ×1; F, leaf, ×16; G, upper leaf cells and margin, ×270; H, capsule, ×8.

I–L, *Brotherella deplanatula:* I, plant, ×1; J and K, leaves, ×16; L, leaf apex, ×110.

pinnately branched, branches suberect, 2–2.5 cm. high, irregularly rebranched. Leaves of secondary stems crowded, laxly imbricated when dry, erect-spreading when moist, oblong-ovate, abruptly short acuminate, lightly concave, about 2 mm. long, 1 mm. wide; margins erect, entire below, minutely denticulate toward apex; costa double, short; upper leaf cells oval-rhomboidal, basal cells linear, smooth, alar cells 5, oblong-vesiculose. Perichaetium large, 3–3.5 mm. long; seta smooth, reddish, 8–9 mm. long; capsule cylindrical, inclined, urn 1 mm. long, strongly contracted under the mouth when dry. (Fig. 172, A–D.)

Dept. Izabal: Along Rio Frio, alt. 75 m., *Steyermark 39923* TYPE. Dept. Alta Verapaz: *Steyermark 44704.*

Endemic.

Compared with any of the forms of *S. caespitosum* the epiphytic habit on branches is different, the leaves are larger, the alar cells more numerous and better defined, without any supra-alar group and the perichaetia are consistently much longer and more conspicuous.

7. SEMATOPHYLLUM SERICIFOLIUM Mitt., Journ. Linn. Soc. **12**: 483. 1869.

Rhaphidostegium chrysocladum Card., Rev. Bryol. **37**: 57. 1910.

Plants slender, pale yellowish green; stems 1–2 cm. long, irregularly branched. Leaves close, erect-spreading, often homomallous, 1 mm. long, lanceolate, concave, slenderly acuminate, ecostate, entire; cells linear, alar cells 2 or 3, oblong, inflated, hyaline or yellowish, subquadrate supra-alar cells in 2 or 3 rows. Perichaetial leaves to 1.5 mm. long, lanceolate, long acuminate, minutely serrulate above; seta slender, 5–10 mm. long; capsule inclined, oblong, urn 1 mm. long. (Fig. 172, E–H.)

Dept. Peten: *Lundell 2835.* Dept. Huehuetenango: *Standley 82144.* Dept. Quezaltenango: *Steyermark 34914, 35108; Standley 83571.*

Distribution: Mexico, Cuba.

On logs and damp banks at medium to rather high altitudes. As far as I can see the distinctions between *R. chrysocladum* and *S. sericifolium* are too weak to be of any practical value.

8. SEMATOPHYLLUM ANGUSTIRETE Bartr., Bryol. **50**: 207. 1947.

Rupestrine plants, golden green, glossy, in deep tufts. Stems creeping, branches suberect, crowded, turgid, to 2 cm. long, often rebranched. Leaves crowded, closely imbricated, erect-spreading, concave, oblong-ovate, abruptly short acuminate, about 2 mm. long, 0.6 mm. wide; margins erect, entire; cells narrowly linear, 75–100 μ

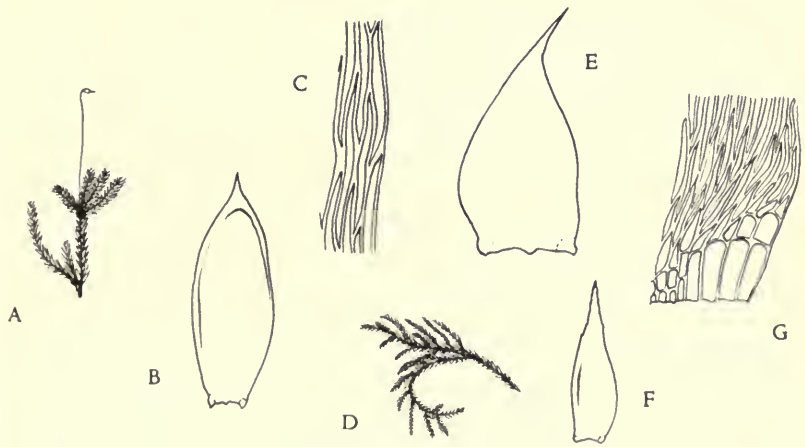

FIGURE 173

A–C, *Sematophyllum angustirete:* A, plant, ×1; B, leaf, ×14; C, upper leaf cells and margin, ×338.

D–G, *Acanthocladium costaricense:* D, part of plant, ×1; E, stem leaf, ×28; F, branch leaf, ×28; G, basal angle of stem leaf, ×338.

long, 4–5 μ wide, colored across insertion, alar cells 3–4, oblong, vesiculose. Perichaetial leaves gradually acuminate; seta 12–14 mm. long, reddish; capsule inclined, curved, asymmetrical, urn 1.5 mm. long; lid obliquely subulate-rostrate. (Fig. 173, A–C.)

Dept. Baja Verapaz: *Sharp 5120.*

Endemic.

On boulder at low altitude. The crowded, turgid branches, somewhat cuspidate at the tips, give these plants a characteristic and unusual appearance. The leaves are more densely imbricated, more slenderly acuminate and the areolation is much longer and narrower than in *S. marylandicum* (C. M.) E. G. Britt.

EXCLUDED SPECIES

APTYCHUS APALOBLASTUS C. M., Bull. Herb. Boiss. **5**: 212. 1897.

APTYCHUS LONGICOLLIS C. M., Bull. Herb. Boiss. **5**: 213. 1897.

APTYCHUS SEMITORTULUS C. M., Bull. Herb. Boiss. **5**: 213. 1897.

The descriptions of the above species suggest that they may represent forms of *S. caespitosum* but the types are not available for comparison.

5. BROTHERELLA Loeske, Stud. 175. 1910.

Slender, glossy plants; stems prostrate. Leaves falcate-secund, acuminate, serrulate above, ecostate; cells linear, alar cells inflated. Seta elongate; capsules inclined, exothecial cells rectangular, not collenchymatous.

1. BROTHERELLA DEPLANATULA (Card.) Broth., E. & P. Pflanzenf. Ed. 2, **11**: 425. 1925.

Hypnum deplanatulum Card., Rev. Bryol. **37**: 56. 1910.

Autoicous; plants yellowish green, glossy, in lax mats; stems to 3 cm. long, pinnate, branches spreading, curved, complanate-foliate. Leaves 1.5 mm. long, slightly falcate, ovate-lanceolate, long acuminate, ecostate; margins often narrowly recurved below, serrulate toward apex; cells linear, alar cells 3–5, oblong, inflated, hyaline or yellowish. Seta slender, to 2 cm. long, red; capsule inclined, cylindrical, curved; lid conic-rostrate. (Fig. 172, I–L.)

Dept. Quezaltenango: *Standley 85906, 86054.*

Distribution: Mexico.

On logs at high altitudes. Although sterile these collections almost surely belong here as the gametophyte characters are identical with those of the type collection. The serrulate leaves and the rectangular exothecial cells, not thickened at the corners, will separate the plants from *Sematophyllum*.

6. ACROPORIUM Mitt., Journ. Linn. Soc. **1868**: 182. 1868.

Plants slender to robust, in dense tufts; stems creeping, branches numerous, suberect, densely foliate, cuspidate at tips. Leaves erect-spreading, ovate-lanceolate, acuminate, subentire, ecostate; cells linear, smooth, alar group conspicuous, sharply defined. Seta slender; capsules suberect; peristome teeth transversely striolate, with a narrow median furrow; lid long and slenderly beaked.

1. ACROPORIUM PUNGENS (Hedw.) Broth., E. & P. Pflanzenf. Ed. 2, **11**: 436. 1925.

Hypnum pungens Hedw., Sp. Musc. 237. 1801.

Synoicous; plants glossy, pale yellowish green; branches to 4 or 5 cm. high, subpinnately rebranched. Leaves laxly erect-spreading

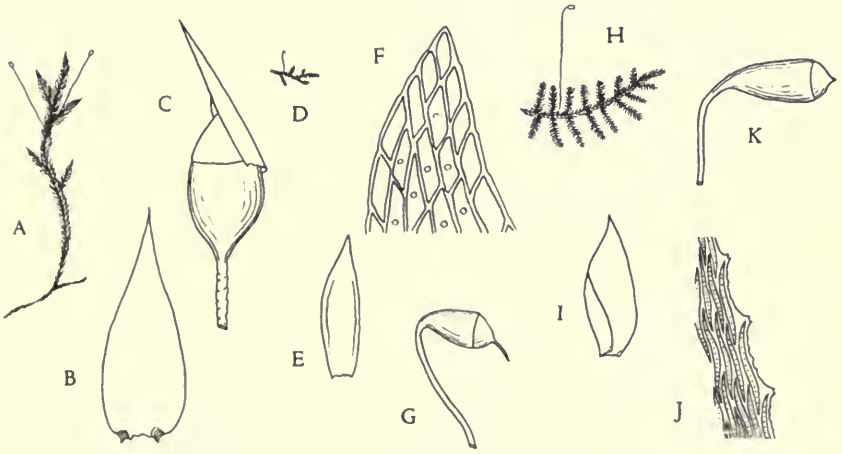

FIGURE 174

A–C, *Acroporium pungens:* A, plant, ×1; B, leaf, ×16; C, capsule, ×10.

D–G, *Trichosteleum fluviale:* D, plant, ×1; E, leaf, ×24; F, apex of leaf, ×270; G, capsule, ×16.

H–K, *Taxithelium planum:* H, part of plant, ×1; I, leaf, ×16; J, upper leaf cells and margin, ×270; K, capsule, ×10.

to subsecund, 2–2.5 mm. long, lanceolate, gradually acuminate; margins involute toward apex, denticulate at extreme point; cells linear, shorter and yellow across insertion, alar cells 3–4, large, oblong, inflated, hyaline or colored, in a contracted, subauriculate group. Perichaetium small, inner leaves 1 mm. long, ovate, acuminate, serrulate above; seta slender, red, 10–12 mm. long, scabrous near tip, smooth below; capsule erect, 1 mm. long, obovoid, exothecial cells collenchymatous; lid 1 mm. long; peristome teeth pale brown, 375 μ high, with a narrow median slit. (Fig. 174, A–C.)

Dept. Izabal: *Steyermark 38805*. Dept. Alta Verapaz: *Standley 69333, 70062*.

Distribution: West Indies, Central and South America.

On tree trunks at low to medium altitudes. Widely distributed and easily recognized by the pale, sharply pointed leaves spreading on all sides and cuspidate at the tips of the branches and the numerous setae usually borne well up on the branches.

7. TRICHOSTELEUM (Mitt.) Jaeg., Adumb. **2**: 477. 1876–77.

Sematophyllum sec. *Trichosteleum* Mitt., Journ. Linn. Soc. **12**: 476. 1869.

Plants usually small, in thin mats; stems creeping, irregularly branched. Leaves ovate-lanceolate, acuminate, ecostate, usually toothed above; cells elongate, unipapillate in our species, alar cells large, inflated. Seta slender, smooth or papillose above; capsules pendulous, minute; peristome teeth with a median furrow; lid with a long, needle-like beak.

Leaves with short, broad points, seta to 3.5 mm. long.....1. *T. fluviale*

Leaves subulate-acuminate, seta 6 mm. long.....2. *T. Bernoullianum*

1. TRICHOSTELEUM FLUVIALE (Mitt.) Jaeg., Adumb. **2**: 485. 1876–77.

Sematophyllum fluviale Mitt., Journ. Linn. Soc. **12**: 493. 1869.

Autoicous; minute, pale green plants in thin mats; stems 3–5 mm. long, irregularly branched, complanate-foliate. Leaves 0.9 mm. long, oblong-lanceolate, short acuminate, concave, subentire; cells linear-rhomboidal, with a single large papilla over center of lumen. Perichaetial leaves 1 mm. long, subulate-acuminate, serrulate above; seta 2.5–3.5 mm. long, smooth; capsule pyriform, urn 0.4 mm. long. (Fig. 174, D–G.)

Dept. Izabal: *Steyermark 39756*.

Distribution: Panama, Colombia.

On log near sea level.

2. TRICHOSTELEUM BERNOULLIANUM (C. M.) Broth., E. & P. Pflanzenf. 1^3: 1119. 1908.

Sigmatella Bernoulliana C. M., Bull. Herb. Boiss. **5**: 213. 1897.

More robust than *T. fluviale;* leaves subulate-acuminate. Seta 6 mm. long, smooth; capsule cylindrical, urn 0.6 mm. long.

Mazatenango: *Bernoulli & Cario 76.*

Endemic.

The type is not available and the distinctions, such as they are, are based on sketches made by Mr. Williams in the New York Botanical Garden, evidently from a scrap of the type collection which was returned to Berlin.

8. TAXITHELIUM Spruce, Catal. 1867.

Slender, mostly corticolous plants in thin mats; stems creeping, subpinnate, complanate-foliate. Leaves ovate, ecostate, concave, serrulate, lateral rows spreading, median rows smaller, appressed; cells linear, seriate papillose, alar cells differentiated. Seta elongate, smooth; capsules ovoid, inclined; lid conical, short; peristome complete.

1. TAXITHELIUM PLANUM (Brid.) Mitt., Journ. Linn. Soc. **12**: 496. 1869.

Hypnum planum Brid., Musc. Rec. Suppl. **2**: 97. 1812.

?Sigmatella pseudo-acuminatula C. M., Bull. Herb. Boiss. **5**: 214. 1897.

Autoicous; plants dull green in lax, thin mats; stems to 4 cm. long or longer, pinnate, strongly complanate-foliate, 1.5–2 mm. wide. Lateral leaves rather widely spreading, to 1.2 mm. long, 0.5 mm. wide, ovate, short acuminate, concave, serrulate nearly all around; cells linear, seriate papillose over lumens, shorter and smooth across insertion, alar cells 3–4, oblong, slightly enlarged, hyaline, not conspicuous. Seta slender, to 1.5 cm. long; capsule horizontal, ovoid, urn to 1 mm. long; lid conical. (Fig. 174, H–K.)

Dept. Izabal: *Steyermark 39276, 39586, 39587, 39757, 41695; H. Johnson 1117.*

Distribution: Florida, Mexico, West Indies, Central and South America.

On tree trunks and logs at low altitudes. This common tropical American species varies somewhat in leaf outline and I should imagine might well include *Sigmatella pseudo-acuminatula*, no specimen of which is available.

9. GLOSSADELPHUS Fleisch., Laubmfl. Java **4**: 1351. 1920.

Plants rather slender, growing in thin, flat mats; stems creeping, irregularly pinnate, complanate-foliate. Leaves oblong to ligulate, obtuse or broadly rounded, toothed toward apex; costa short and double; cells linear, usually papillose at apical angles. Seta elongate, smooth; capsules ovoid; lid conical; peristome complete.

Leaves oblong-ovate, broadly rounded or truncate ..... 1. *G. cocoensis*
Leaves ligulate, obtuse ..... 2. *G. ligulaefolius*

1. GLOSSADELPHUS COCOENSIS (Williams) Bartr., Proc. Cal. Acad. Sci. Ser. 4, **21**: 86. 1933.

Hookeriopsis cocoensis Williams, Bryol. **27**: 40. 1924.
Glossadelphus longisetus Bartr., Contrib. U. S. Nat. Herb. **26**[3]: 109. 1928.

Autoicous; stems 2–3 cm. long, subpinnately branched, branches 2 mm. wide. Leaves oblong, concave, truncate or broadly rounded, to 0.9 mm. long; margins erect, serrulate below, coarsely and irregularly toothed at apex with the teeth often bifid; costa lacking or short and double; cells linear, minutely papillose at apical angles. Seta 1–3 cm. long, smooth or slightly scabrous above; capsule inclined, ovoid, urn 1.5–2 mm. long; lid conical, to 1 mm. long. (Fig. 175, A–C.)

Dept. Izabal: *Steyermark 41867, 41868.* Dept. Quezaltenango: *Steyermark 33375.*

Distribution: Costa Rica, Galapagos Islands.

On tree trunks at rather low altitudes. Williams describes the species as synoicous but all the plants from Costa Rica that I have examined are autoicous. As there are no other apparent differences I believe they are all representative of one specific type.

2. GLOSSADELPHUS LIGULAEFOLIUS Bartr., Bryol. **49**: 123. 1946.

Dioicous? no female flowers seen. Slender, yellowish green, glossy plants in soft, thin mats; stems prostrate, to 2 cm. long, sparingly branched, complanate-foliate, obtuse. Leaves unaltered

when dry, erect-spreading, ligulate, obtuse, ecostate, to 1.2 mm. long, 0.23 mm. wide; margins plane, denticulate above, entire below, inflexed on one side toward base; leaf cells narrowly linear, smooth or very minutely papillose at apical angles, shorter and pale yellow across insertion and slightly shorter in the extreme apex. Sporophyte unknown. (Fig. 175, D–G.)

Dept. Izabal: Jungle between Escobas and waterfall, across bay from Puerto Barrios, alt. 20–50 m., *Steyermark 39846* (as *Plagiothecium ligulaefolium* sp. nov.).

Distribution: Mexico.

Distinguished at once from *G. cocoensis* by the narrower, flat, ligulate leaves, less broadly rounded at apex and more weakly toothed with simple, not bifid, teeth.

46. HYPNACEAE

Plants often glossy, growing in intricate mats; stems creeping, often pinnate or subpinnate. Leaves ovate or ovate-lanceolate, usually acuminate, often falcate-secund; costa lacking or short and double; cells linear, prosenchymatous, smooth or faintly papillose at apical angles, alar cells small, not inflated. Seta elongate, smooth;

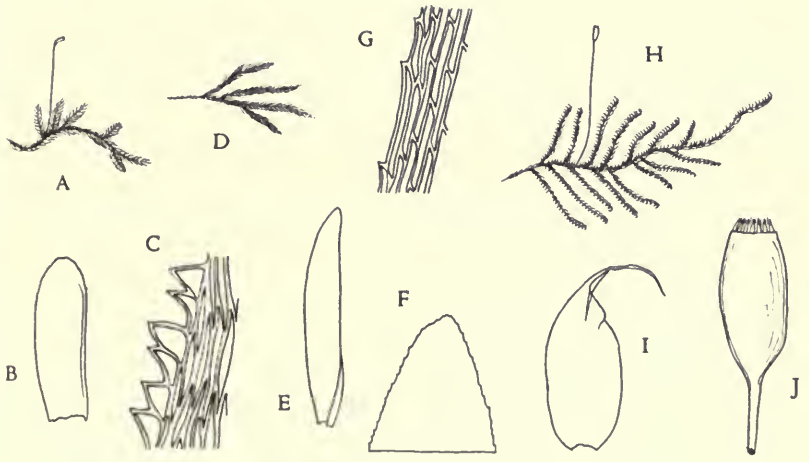

FIGURE 175

A–C, *Glossadelphus cocoensis:* A, plant, ×1; B, leaf, ×24; C, upper leaf cells and margin, ×270.

D–G, *Glossadelphus ligulaefolius:* D, plant, ×1; E, leaf, ×24; F, apex of leaf, ×110; G, upper leaf cells and margin, ×270.

H–J, *Stereodon falcatus:* H, plant, ×1; I, leaf, ×16; J, capsule, ×10.

capsules ovoid, asymmetrical, rarely erect and cylindrical; peristome double, complete; lid conic-apiculate; calyptra cucullate.

1. Leaves in 4 rows, lateral rows ovate, ventral rows lanceolate..9. *Rhacopilopsis*
   Leaves in many rows, not differentiated....2
2. Capsules erect....3
   Capsules nodding or pendulous....4
3. Leaves falcate-secund, entire....1. *Stereodon*
   Leaves erect-spreading, serrulate all around....5. *Ctenidiadelphus*
4. Leaf cells short and lax, oval or rhomboidal....4. *Vesicularia*
   Leaf cells long and narrow....5
5. Leaves serrulate to base, often papillose on back by projecting cell angles....6
   Leaves serrulate only near apex, smooth on back....8
6. Alar cells numerous, lax and decurrent....6. *Ctenidium*
   Alar cells small, few, not decurrent....7
7. Leaves strongly plicate, alar cells not differentiated....8. *Puiggariella*
   Leaves not or faintly striate, alar cells differentiated....7. *Mittenothamnium*
8. Capsules oblong or cylindrical....2. *Hypnum*
   Capsules short ovoid, contracted under the flaring mouth when dry
   3. *Ectropothecium*

1. STEREODON Mitt., Journ. Linn. Soc. **12**: 22. 1869, emend. Fleisch., Nova Guinea 12 Bot. **2**: 122. 1914.

Plants densely matted; stems pinnate. Leaves falcate-secund, acuminate, entire; cells linear, alar cells small, rounded. Seta elongate; capsules erect; peristome teeth smooth; spores relatively large.

1. STEREODON FALCATUS (Schimp.) Fleisch., Nova Guinea 12 Bot. **2**: 122. 1914.

Pylaisia falcata Schimp., Prodr. Bryol. Mex. 103. 1871.

Autoicous; slender, glossy, golden brown plants in dense mats; stems prostrate, closely pinnate. Leaves falcate-secund, to 1.5 mm. long, ovate-lanceolate, long and slenderly acuminate, entire, ecostate; cells narrowly linear, incrassate, alar cells small, rounded, incrassate, colored, rather numerous. Seta slender, 1–2 cm. long; capsule erect, oblong-cylindric, urn 1.5 mm. long; peristome teeth pale brown not transversely striolate, segments from a high basal membrane, as long as teeth; lid conical; spores 24–30 μ. (Fig. 175, H–J.)

Dept. Huehuetenango: *Standley 62666* (as *Hypnum amabile*), *81128*, *81795*. Dept. Totonicapan: *Standley 84028*, *84525a*. Dept. Sacatepequez: *Standley 65245*

(as *Hypnum amabile*). Dept. Chimaltenango: *Standley 61830* (as *Hypnum amabile*). Dept. Solola: *Steyermark 47580.*

Distribution: Mexico.

On shaded rocks, banks and trees and in alpine meadows, all at high altitudes. I find considerable variation in the size of the spores and wonder how much practical value this character has as a specific indicator in this group. The erect capsules in combination with the falcate-secund leaves marks this species very clearly in the local flora.

2. HYPNUM Hedw., Sp. Musc. 236. 1801.

Plants slender to robust, usually glossy, in intricate mats; stems creeping or ascending, pinnate or subpinnate, paraphyllia often present, branches hooked at tips. Leaves falcate-secund; costa lacking or short and double; cells linear, usually well differentiated at basal angles. Seta elongate; capsules oblong-cylindric, often curved, inclined or horizontal; lid conical; peristome complete.

1. Leaves plicate 2
   Leaves not plicate 3
2. Leaves short acuminate, alar cells small, quadrate ..... 1. *H. polypterum*
   Leaves long acuminate, alar cells lax, hyaline ..... 2. *H. amabile*
3. Robust plants, leaves 2.5–3 mm. long ..... 3. *H. mirabile*
   Slender plants, leaves 2 mm. or less long 4
4. Leaves broadly acuminate, sharply serrate above ..... 4. *H. aureo-nitens*
   Leaves subulate-acuminate, serrulate above ..... 5. *H. cupressiforme*

1. HYPNUM POLYPTERUM (Mitt.) Broth., E. & P. Pflanzenf. Ed. 2, 11: 454. 1925.

Ectropothecium polypterum Mitt., Journ. Linn. Soc. **12**: 514. 1869.

Cupressina minutidens C. M., Bull. Herb. Boiss. **5**: 216. 1897.

Dioicous; plants golden green, glossy; stems to 6 or 8 cm. long, closely pinnate. Leaves about 2 mm. long, plicate, strongly falcate, lanceolate from a broad, subcordate, often auriculate base, gradually short acuminate, minutely denticulate all around; costa extending about ¼ up leaf; cells very long and narrow, moderately incrassate, alar cells oval, incrassate, in a small, convex group, usually well defined. Seta to 3 cm. long, reddish; capsule inclined, oblong-cylindric, curved, urn 2.5–3 mm. long. (Fig. 176, A–D.)

Dept. Quezaltenango: *Standley 85702.* Dept. Zacapa: *Steyermark 43312.*

Distribution: Costa Rica, Panama, Jamaica, Guadeloupe.

On trees and logs at high altitudes.

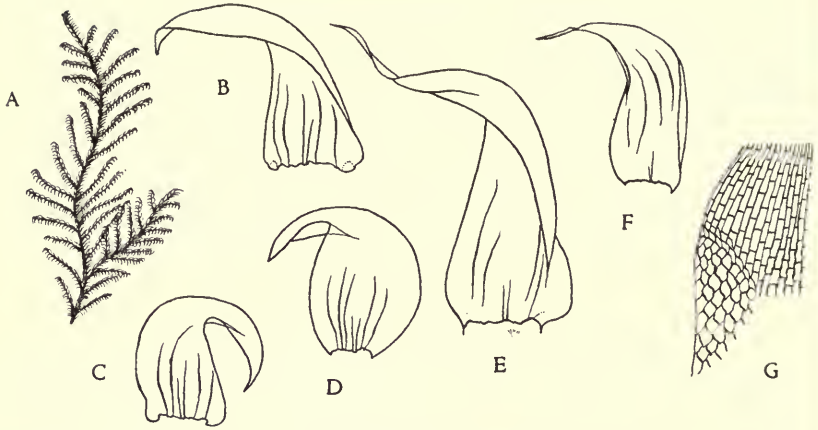

FIGURE 176

A–D, *Hypnum polypterum:* A, part of plant, ×1; B, stem leaf, ×16; C, branch leaf, ×16; D, branch leaf of var. *robustum*, ×16.

E–G, *Hypnum amabile:* E, stem leaf, ×16; F, branch leaf, ×16; G, basal angle of stem leaf, ×110.

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var. ROBUSTUM Bartr., Contrib. U. S. Nat. Herb. **26**[3]: 110. 1928.

More robust and more irregularly branched. Leaves broader, acumen shorter and broader.

Dept. Huehuetenango: *Steyermark 48487, 48488a.* Dept. Totonicapan: *Standley 65870, 65882.* Dept. Chimaltenango: *Standley 58722, 58741, 58746, 58747, 60963, 61111a.* Dept. Guatemala: *Standley 58505, 80566.* Dept. Jalapa: *Steyermark 32623a.*

Distribution: Costa Rica.

On trees and banks at high altitudes. Curiously enough the var. *robustum* is more frequent in Guatemala than the slenderer typical form.

2. HYPNUM AMABILE (Mitt.) Broth., E. & P. Pflanzenf. Ed. 2, **11**: 454. 1925.

Ectropothecium amabile Mitt., Journ. Linn. Soc. **12**: 513. 1869.

Hypnum LeJolisii Besch., Prodr. Bryol. Mex. 108. 1871.

Dioicous; plants pale yellowish green, glossy, in lax tufts; stems red, to 10 cm. or more long, closely and regularly pinnate. Stem leaves falcate-secund, 3–3.5 mm. long, gradually lanceolate from a broad, subcordate base, long subulate acuminate, minutely and remotely denticulate; costa lacking or very short; cells linear, alar cells numerous, oblong, lax and hyaline, usually in a well defined

and inflated group and often decurrent. Branch leaves lanceolate, smaller, narrower. Seta long; capsule large, arcuate, sporophyte not seen. (Fig. 176, E–G.)

Dept. Huehuetenango: *Standley 83084, 83091, 81125; Steyermark 50173b.* Dept. San Marcos: *Steyermark 35492a, 35504; Standley 85375.* Dept. Totonicapan: *Standley 62678, 62696b, 62734a, 84010, 84453, 84529, 84537.* Dept. Quezaltenango: *Steyermark 34821, 34854a; Standley 86181.*

Distribution: Mexico, Colombia.

On trees, banks and rocks in alpine regions. Readily separated from *H. polypterum* by the slenderly acuminate leaves and the hyaline, decurrent alar cells.

3. HYPNUM MIRABILE Bartr., Bryol. **50**: 208. 1947.

Robust plants in dense masses, lustrous golden green above, brown below. Stems to 7 cm. long, profusely branched, branches hooked at tips. Leaves crowded, moderately falcate-secund, 2.5–3 mm. long, 1 mm. wide, oblong-ovate from a cordate base, abruptly acuminate, concave, not plicate; margins erect, serrulate toward apex; costa double, short; cells narrowly linear, vermicular, incrassate, alar cells numerous, rounded-quadrate, brownish, strongly incrassate, forming a large, conspicuous group. Fruit unknown. (Fig. 178, A–C.)

Dept. Huehuetenango: *Sharp 4999.*

Endemic.

On limestone boulder at high altitude. Distinct from *H. polypterum* in the non-plicate, longer acuminate leaves, toothed toward the apex and from *H. amabile* by the conspicuous convex group of small, highly colored cells at the basal leaf angles.

4. HYPNUM AUREO-NITENS Bartr., Bryol. **49**: 124. 1946.

Dioicous; slender, glossy, golden brown plants in extensive, flat mats; stems to 3 cm. long, subpinnately branched. Leaves falcate-secund, 1–1.5 mm. long, oblong-lanceolate, concave, broadly acuminate; margins recurved below, sharply serrate above; costa double, well defined, one fork often longer and extending nearly ¼ up leaf; upper cells long hexagonal, 8–10 μ wide, basal cells linear, subquadrate alar cells large, numerous, opaque, with yellowish, incrassate walls. Fruit unknown. (Fig. 177, A–D.)

Dept. San Marcos: *Standley 85416.* Dept. Totonicapan: Region of Salvachan, mountains above Totonicapan just before reaching Desconsuelo, alt. about 3,100 m., *Standley 84490, 84511,* TYPE.

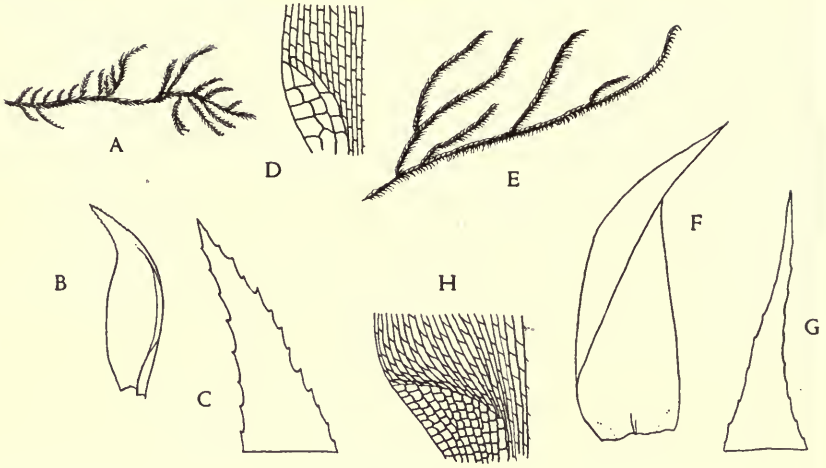

FIGURE 177

A–D, *Hypnum aureo-nitens:* A, plant, ×1; B, leaf, ×24; C, apex of leaf, ×110; D, basal angle of leaf, ×110.

E–H, *Hypnum cupressiforme:* E, plant, ×1; F, leaf, ×24; G, apex of leaf, ×110; H, basal angle of leaf, ×110.

Endemic.

On tree trunk, damp bank and wet meadow at high altitudes. This species is evidently near *H. reptile* Mx. but appears to be well defined by the lustrous, golden brown coloring, larger and less slenderly acuminate leaves and the much longer, narrower cells in the leaf base. The quadrate alar cells are also larger and rather less numerous than in *H. reptile.*

5. HYPNUM CUPRESSIFORME Hedw., Sp. Musc. 291. 1801.

Dioicous; plants yellowish green, paler at tips, in thin mats; stems to 7 or 8 cm. long, irregularly pinnate. Leaves crowded, falcate-secund, to 2 mm. long, oblong-lanceolate, subulate-acuminate, concave, not plicate, minutely serrulate toward apex; costa short; cells narrowly linear, alar cells numerous in a conspicuous group, larger and colored at the extreme basal angles, smaller and opaque above. Seta about 2 cm. long, red; capsule suberect, curved, oblong-cylindric. (Fig. 177, E–H.)

Dept. Quezaltenango: *Steyermark 34869, 34870* (both as *H. amabile*).

Distribution: Cosmopolitan.

Alpine regions on Volcan Zunil. These are the first records for Central America of this widely distributed, variable species. Although sterile the collections are thoroughly typical, especially in the characteristic group of alar cells.

3. ECTROPOTHECIUM Mitt., Journ. Linn. Soc. **12**: 22. 1869.

Plants in extensive, thin mats; stems creeping, pinnate. Leaves symmetrical, falcate-secund; costa lacking or short and double; cells linear, not conspicuously differentiated at basal angles. Seta elongate, smooth; capsules horizontal or pendulous, short, ovoid, strongly constricted under mouth when dry; peristome double, complete.

Stems regularly pinnate, leaves narrow, subulate-acuminate.....1. *E. apiculatum*

Stems irregularly branched, leaves broader, short acuminate.....2. *E. globitheca*

1. ECTROPOTHECIUM APICULATUM (Hornsch.) Mitt., Journ. Linn. Soc. **12**: 512. 1869.

Hypnum apiculatum Hornsch., Fl. Bras. **1**: 87. 1840.

Autoicous; plants yellowish green; stems to 4 cm. long, regularly pinnate. Stem leaves 1–1.3 mm. long, ovate-lanceolate, subulate-

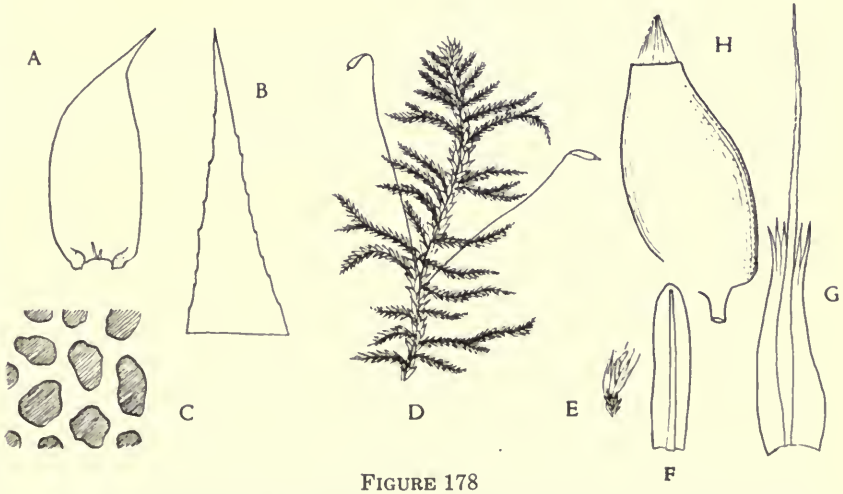

FIGURE 178

A–C, *Hypnum mirabile:* A, leaf, ×14; B, apex of leaf, ×134; C, alar cells, ×270.
D, *Hylocomium brevirostre:* D, part of plant, ×1.
E–H, *Diphyscium foliosum:* E, plant, ×1; F, stem leaf, ×10; G, perichaetial leaf, ×10; H, capsule, ×10.

acuminate, serrate above, serrulate below; costa extending about ⅓ up leaf; cells narrowly linear, scarcely differentiated at basal angles. Branch leaves narrower. Seta 1.5–2 cm. long; capsule subpendulous, urn 1 mm. long; lid convex, apiculate. (Fig. 179, A–C.)

Dept. Peten: *Steyermark 45514*. Dept. Izabal: *Steyermark 39903*. Dept. Alta Verapaz: *Steyermark 44971*. Dept. Chiquimula: *Steyermark 31409*.

Distribution: Mexico, Costa Rica, Panama, West Indies, Colombia, Brazil.

On damp rocks and trees at low altitudes. The narrower, more sharply pointed leaves, coarsely toothed above, will assist in separating this species from the following, which is uncomfortably close.

2. ECTROPOTHECIUM GLOBITHECA (C. M.) Mitt., Journ. Linn. Soc. **12**: 512. 1869.

Hypnum globitheca C. M., Syn. **2**: 300. 1851.

?Cupressina acrostegia C. M., Bull. Herb. Boiss. **5**: 216. 1897.

Autoicous; plants similar to *E. apiculatum* but less regularly branched. Branch leaves more broadly ovate, shorter acuminate and less sharply toothed above. Capsules asymmetrical; lid short beaked from a convex base. (Fig. 179, D–G.)

Dept. Zacapa: *Steyermark 29384*.

Distribution: Nicaragua, West Indies, South America.

On rocks at low altitudes. *Cupressina acrostegia* C. M. is almost surely a synonym of either this or the preceding species, but of which one is a question that cannot be answered until the type is available for comparison.

4. VESICULARIA (C. M.) C. M., Flora **82**: 467. 1896.

Omalia subsec. 1, *Vesicularia* C. M., Syn. **2**: 233. 1851.

Plants dull green in extensive thin mats; stems mostly regularly pinnate, branches widely spreading, complanate-foliate. Leaves entire or weakly toothed, the lateral rows spreading or slightly falcate; costa lacking or faint; cells lax, oval-rhomboidal, alar cells not differentiated. Sporophyte as in *Ectropothecium*.

Marginal cells of upper part of leaf much narrower than the median cells
1. *V. amphibola*

Marginal cells not appreciably narrower, similar to the median cells
2. *V. vesicularis*

1. VESICULARIA AMPHIBOLA (Spruce) Broth., E. & P. Pflanzenf. 1^3: 1094. 1908.

Ectropothecium amphibolum Spruce, Journ. Linn. Soc. **12**: 519. 1869.

?Vesicularia arcuatipes C. M., Bull. Herb. Boiss. **5**: 211. 1897.

?Vesicularia thermalis C. M., Bull. Herb. Boiss. **5**: 212. 1897.

Autoicous; plants yellowish green; stems elongate, branches short, divergent. Leaves spreading, slightly contorted when dry, ovate, acuminate, denticulate above, to 1.5 mm. long; costa lacking or short; cells oval-hexagonal, thin walled, about 15 μ wide, 80–100 μ long, marginal row narrower. Seta 1–1.5 cm. long; capsule short, ovoid, urn about 1 mm. long. (Fig. 179, H–J.)

Dept. Peten: *Steyermark 45488, 46140.* Dept. Izabal: *Steyermark 39055; Standley 72419.* Dept. Alta Verapaz: *Steyermark 44278.* Dept. San Marcos: *Standley 68845.* Dept. Retalhuleu: *Steyermark 34538.* Dept. Escuintla: *Standley 63557.* Dept. Zacapa: *Steyermark 29389a.* Dept. Santa Rosa: *Standley 78567.*

Distribution: Florida, West Indies, Central and South America.

On wet rocks, banks, trees and logs at low altitudes. This is not a clean-cut species and is often difficult to distinguish from the following.

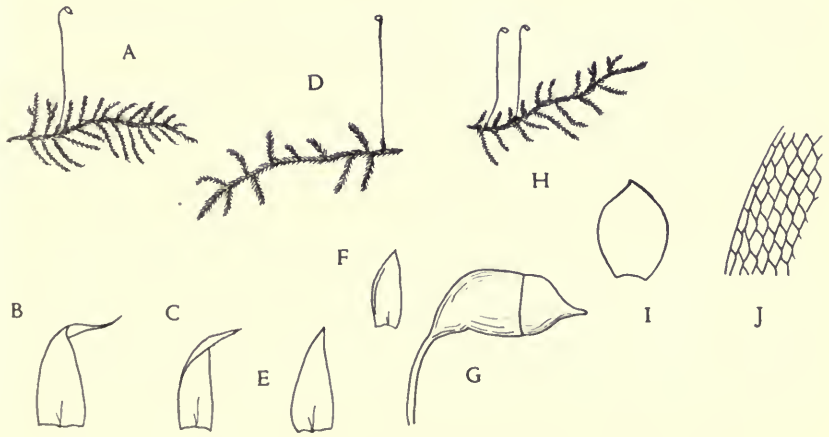

FIGURE 179

A–C, *Ectropothecium apiculatum:* A, plant, ×1; B, stem leaf, ×16; C, branch leaf, ×16.

D–G, *Ectropothecium globitheca:* D, plant, ×1; E, stem leaf, ×16; F, branch leaf, ×16; G, capsule, ×8.

H–J, *Vesicularia amphibola:* H, plant, ×1; I, leaf, ×16; J, upper leaf cells and margin, ×110.

2. VESICULARIA VESICULARIS (Schwaegr.) Broth., E. & P. Pflanzenf. 1[3]: 1094. 1908.

Hypnum vesicularis Schwaegr., Suppl. 2: 167. 1827.

?Vesicularia pseudo-rutilans C. M., Bull. Herb. Boiss. 5: 211. 1897.

Autoicous; plants similar to *V. amphibola* in habit and appearance. Leaves broadly ovate, subentire; cells shorter, to 40–50 μ long, not narrower at margins. (Fig. 180, A–B.)

Dept. Peten: *Steyermark 46139.* Dept. Izabal: *Steyermark 38820, 39755, 39780, 39998, 41828.* Dept. Alta Verapaz: *Steyermark 44304.* Dept. San Marcos: *Steyermark 36891, 36892, 36903.* Dept. Retalhuleu: *Steyermark 34545; Standley 87197.* Dept. Escuintla: *Standley 63564.* Dept. Jalapa: *Steyermark 32910, 32922.*

Distribution: Florida, West Indies, South America.

On various damp substrata at low altitudes. As far as I can judge from the description *V. pseudo-rutilans* belongs here while *V. arcuatipes* and *V. thermalis* are tentatively included with *V. amphibola.*

var. POEPPIGIANA (Hampe) Broth., E. & P. Pflanzenf. 1[3]: 1094. 1908.

Hookeria Poeppigiana Hampe, Icon. Musc. pl. 4. 1844.

Leaves more or less falcate and hooked at tips of stems and branches.

Dept. Izabal: *Steyermark 41866b.* Dept. Escuintla: *Standley 63546.*

Distribution: Florida, West Indies.

Like the typical form, a lowland plant of damp habitats.

5. CTENIDIADELPHUS Fleisch., Laubmfl. Java 4: 1467. 1922.

Plants slender, growing in rather dense, feathery mats or tufts; stems prostrate, branches ascending, complanate-foliate. Branch leaves spreading, subdistichous, lanceolate, acuminate, serrulate all around; costa double, short; cells linear. Seta slender, smooth; capsules erect, cylindric; lid conical; peristome double, teeth minutely papillose, segments from a low basal membrane.

1. CTENIDIADELPHUS CYLINDRICARPUS (Card.) Bartr., Bryol. 49: 124. 1946.

Isopterygium cylindricarpum Card., Rev. Bryol. 37: 56. 1910.

Autoicous; plants yellowish green, slightly glossy; stems to 2 cm. long, subpinnately branched, branches ascending, to 2.5 mm. wide.

Branch leaves widely spreading, complanate, slightly curved or homomallous when dry, to 1.5 mm. long, ovate-lanceolate, gradually long and slenderly acuminate, sharply serrulate all around; costa lacking or short; cells linear, smooth, alar cells scarcely differentiated. Stem leaves smaller, not complanate. Perichaetial leaves small, erect, acuminate, serrulate; seta 10–15 mm. long, reddish below; capsule pale, cylindrical, urn 2.5 mm. long; lid conical, blunt, 0.25 mm. long; peristome pale, segments as long as teeth from a basal membrane about 50 μ high; spores smooth, diameter 8–10 μ. (Fig. 180, C–F.)

Dept. Huehuetenango: *Standley 81813*. Dept. Totonicapan: *Standley 84534*. Dept. Quezaltenango: *Steyermark 34086, 34105, 34121; Standley 86103*. Dept. Chimaltenango: *Standley 60966, 61923*.

Distribution: Mexico, Costa Rica.

On trees, logs and rocks at high altitudes. This clearly marked species has little in common with *Isopterygium*. The erect, narrowly cylindrical capsules and the leaves serrulate to the base suggest *Ctenidiadelphus* more nearly than anything else.

6. CTENIDIUM Schimp., Syn. Ed. 1, 631. 1860.

Slender plants in dense, feathery mats; stems creeping, pinnate. Stem leaves larger and well differentiated from branch leaves, ovate-lanceolate, decurrent, falcate-secund, toothed all around; costa lacking or short; cells linear, often papillose at apical angles, alar cells numerous, differentiated. Seta elongate; capsules nodding, asymmetrical; lid conical; peristome complete; calyptra often pilose when young.

1. CTENIDIUM MALACODES Mitt., Journ. Linn. Soc. **12**: 509. 1869.

Dioicous; plants yellowish green, glossy; stems to 6 cm. long, pinnate. Stem leaves faintly plicate, 1.5–2 mm. long, long and finely acuminate from a broad, cordate-triangular base, decurrent, sharply serrulate all around; costa faint or lacking; cells linear, papillose at apical angles on back, more lax across insertion, irregularly oblong and hyaline in basal auricles. Branch leaves smaller, lanceolate, serrate. Seta to 2 cm. long; capsule ovoid, curved, urn to 2 mm. long; lid conic-rostrate, 1 mm. long. (Fig. 180, G–J.)

Dept. Alta Verapaz: *Standley 91407a, 91408a*. Dept. Huehuetenango: *Steyermark 50030; Standley 65891*. Dept. San Marcos: *Standley 66301a, 68501, 68599, 85399a, 85432, 86201, 86325, 86365, 86421, 86499; Steyermark 35858,*

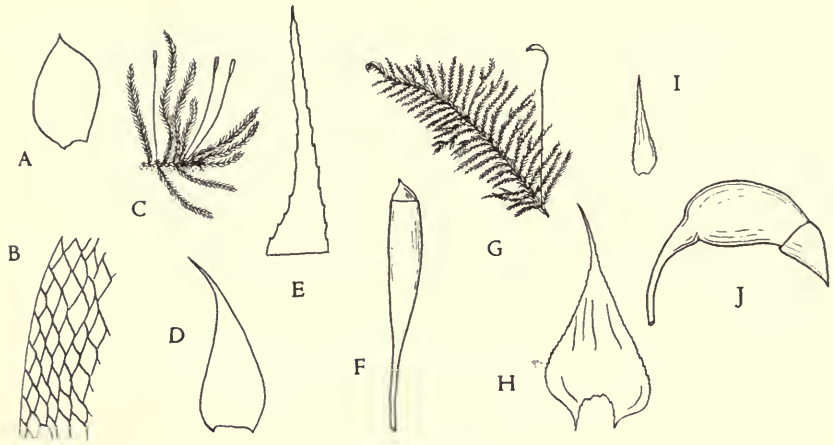

FIGURE 180

A–B, *Vesicularia vesicularis:* A, leaf, ×16; B, upper leaf cells and margin, ×110.

C–F, *Ctenidiadelphus cylindricarpus:* C, plant, ×1; D, leaf, ×16; E, apex of leaf, ×110; F, capsule, ×8.

G–J, *Ctenidium malacodes:* G, plant, ×1; H, stem leaf, ×16; I, branch leaf, ×16; J, capsule, ×10.

36768. Dept. Totonicapan: *Standley 84472.* Dept. Quezaltenango: *Standley 84959, 85070a, 85139.* Dept. Solola: *Steyermark 46954.* Dept. Chimaltenango: *Standley 58776, 58794, 60958a, 60961, 61114, 61836, 61926.*

Distribution: Mexico, Costa Rica, Jamaica, Haiti.

On tree trunks, banks, logs, etc., at medium to high altitudes. Very similar to *Mittenothamnium elegantulum* (Hook.) Card. but usually quite distinct in the falcate-secund leaves. *C. malacodes* is a variable species and may prove to be very close to if not identical with *C. molluscum* (Hedw.) Mitt. The slender, lax form with the branch leaves widely spreading is apparently Mitten's forma *attenuata.*

7. MITTENOTHAMNIUM Hennings, Hedwigia **41**: 225. 1902.

Microthamnium Mitt., Journ. Linn. Soc. **12**: 503. 1869.

Slender plants in extensive mats; stems regularly pinnate and prostrate or more often ascending or arched and dendroid from a stipe-like base, often radiculose at tips. Stem and branch leaves differentiated; stem leaves squarrose-spreading from a subcordate base; costa double; cells linear, often papillose on back at apical

angles. Branch leaves smaller, shorter pointed, more strongly toothed. Seta elongate; capsules subpendulous; lid short, conic-rostrate; peristome complete.

Variable plants widely distributed in tropical America but difficult to identify specifically as no satisfactory method of classification has so far been developed. After studying this group for a year or more I believe Fleischer acknowledged that it was a time-consuming task. I have no reason to disagree with him.

1. Stems prostrate, subpinnately branched, branches short and blunt ..... 1. *M. diminutivum*
   Stems arched, often rooting at tips, wiry, branching above the stipe-like base, branches slender and attenuate 2
2. Stem leaves ovate ..... 6. *M. pendulinum*
   Stem leaves lanceolate from a broad, cordate or triangular base 3
3. Stem leaves narrowly triangular-lanceolate ..... 4. *M. Lehmannii*
   Stem leaves lanceolate from a broader cordate base 4
4. Stem leaves gradually narrowed from a broad, scarcely cordate base, robust plants ..... 5. *M. Langsdorffii*
   Stem leaves abruptly narrowed from a broad, cordate base, more slender plants 5
5. Very slender plants, stem leaves less than 1 mm. long ..... 3. *M. minusculifolium*
   More robust plants, stem leaves 1.5 mm. long ..... 2. *M. reptans*

1. MITTENOTHAMNIUM DIMINUTIVUM (Hampe) E. G. Britt., Bryol. **17**: 8. 1914.

Hypnum diminutivum Hampe, Linnaea **20**: 86. 1847.

Autoicous; plants slender, yellowish green, in rather dense mats; stems to 2 cm. long, prostrate, pinnate. Stem leaves slightly complanate, to 0.8 mm. long, ovate, acuminate, concave, serrulate all around; costa often ending ⅓ to ½ up leaf; cells linear-oblong, prominently papillose on back at apical angles, shorter across insertion, alar cells scarcely differentiated. Branch leaves smaller. Seta about 10 mm. long, capsule cernuous, asymmetrical, urn to 1 mm. long; lid conical, apiculate. (Fig. 181, A–D.)

Dept. Peten: *Steyermark 45384*. Dept. San Marcos: *Standley 68908*. Dept. Sacatepequez: *Standley 58813, 58834, 59013, 64983, 66872, 88962*. Dept. Chimaltenango: *Standley 80320*.

Distribution: Florida, Mexico, Costa Rica, West Indies, South America.

On logs, banks and tree trunks mostly at low altitudes. A common species which is usually readily recognized by the prominent dorsal papillae of the leaf blade.

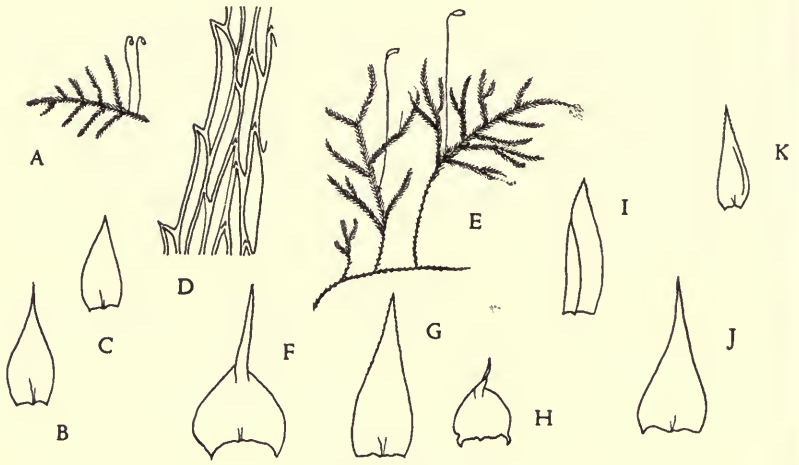

FIGURE 181

A–D, *Mittenothamnium diminutivum:* A, plant, ×1; B, stem leaf, ×16; C, branch leaf, ×16; D, upper leaf cells and margin, ×338.

E–G, *Mittenothamnium reptans:* E, plant, ×1; F, stipe leaf, ×16; G, branch leaf, ×16.

H–I, *Mittenothamnium minusculifolium:* H, stipe leaf, ×16; I, branch leaf, ×16.

J–K, *Mittenothamnium Lehmanii:* J, stipe leaf, ×16; K, branch leaf, ×16.

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2. MITTENOTHAMNIUM REPTANS (Hedw.) Card., Rev. Bryol. **40**: 21. 1913.

Hypnum reptans Hedw., Sp. Musc. 265. 1801.

Plants yellow or yellowish green; stems wiry, arched, radiculose at tips, freely branched above from a simple, stipe-like base. Stipe leaves distant, acuminate from a broadly reniform, cordate base, slightly decurrent, to 1.5 mm. long; costa short, faint; cells linear, larger, oblong and slightly incrassate at basal angles. Branch leaves complanate, ovate-lanceolate, more strongly serrulate. Seta slender, red, 1.5–2 cm. long; capsule ovoid, urn to 1.5 mm. long; lid conic-rostrate, 1 mm. long. (Fig. 181, E–G.)

Dept. Izabal: *Standley 73018.* Dept. Alta Verapaz: *Standley 70061, 70371, 70389, 70416, 70539, 71207, 71209, 71221, 71632, 71699, 71707, 90587, 90696, 91622, 91886a; Steyermark 44765.* Dept. Quiche: *Standley 62406.* Dept. San Marcos: *Standley 68550, 68571a, 68648, 86204, 86223.* Dept. Totonicapan: *Standley 84020.* Dept. Quezaltenango: *Standley 65367, 65378, 66295, 67269, 67437, 67497, 67514, 68253, 83291, 83302, 83354, 86003; Steyermark 33402, 34700.* Dept. Sacatepequez: *Standley 58120, 63722.* Dept. Solola: *Steyermark 47590.* Dept. Chimaltenango: *Standley 57813* (as *M. volvatum*), *57815, 57819, 57821, 57822, 61817, 61936.* Dept. Guatemala: *Standley 80622, 80645.* Dept. Baja

Verapaz: *Standley 69718*. Dept. Zacapa: *Steyermark 29942, 29944*. Dept. Chiquimula: *Steyermark 30821*. Dept. Jalapa: *Steyermark 32482a, 32486a*.

Distribution: Mexico, West Indies, Central and South America.

On tree trunks, logs, banks, etc., at low to medium altitudes. A common, variable, widely distributed species often difficult to separate from its congeners.

3. MITTENOTHAMNIUM MINUSCULIFOLIUM (C. M.) Card., Rev. Bryol. **40**: 21. 1913.

Microthamnium minusculifolium C. M., Bull. Herb. Boiss. **5**: 565. 1897.

Autoicous; plants similar to *M. reptans* but more slender, often with numerous filiform microphyllous branchlets. Stipe leaves smaller, less than 1 mm. long, distinctly auriculate but without differentiated alar cells. Branch leaves narrowly lanceolate, sharply serrulate, cells papillose at apical angles on back. Sporophyte as in *M. reptans*. (Fig. 181, H–I.)

Dept. Izabal: *Steyermark 41915*. Dept. Alta Verapaz: *Steyermark 44445, 44775, 44985; Standley 90607, 90645*. Dept. Quezaltenango: *Steyermark 33442, 33841, 33842, 33843, 33850*.

Distribution: Costa Rica, Jamaica.

On trees, logs, banks, etc., at low to medium altitudes. Apparently distinct from *M. reptans* in the slenderer habit and smaller, auriculate stipe leaves.

4. MITTENOTHAMNIUM LEHMANNII (Besch.) Card., Rev. Bryol. **40**: 21. 1913.

Microthamnium Lehmannii Besch., Bull. Herb. Boiss. **2**: 398. 1894.

Autoicous; plants resembling *M. reptans* but averaging larger. Stipe leaves 1–1.3 mm. long, triangular-lanceolate; cells linear, shorter and incrassate across insertion, not differentiated at basal angles. Branch leaves smaller, lanceolate, sharply serrulate. Seta to 2 cm. long; capsule short, oblong, urn 1–1.2 mm. long. (Fig. 181, J–K.)

Dept. Alta Verapaz: *Standley 69332, 69367, 71207b, 71231, 71594, 90685*. Dept. Huehuetenango: *Steyermark 48789*. Dept. San Marcos: *Steyermark 35867*. Dept. Totonicapan: *Standley 84030*. Dept. Quezaltenango: *Standley 65306, 85070, 85172, 86010, 86037; Steyermark 34938a, 34939*. Dept. Sacatepequez: *Standley 88937*. Dept. Chimaltenango: *Standley 60052, 61827, 80167*. Dept. Zacapa: *Steyermark 42793*. Dept. Chiquimula: *Steyermark 30820a*. Dept. Jalapa: *Steyermark 32530*.

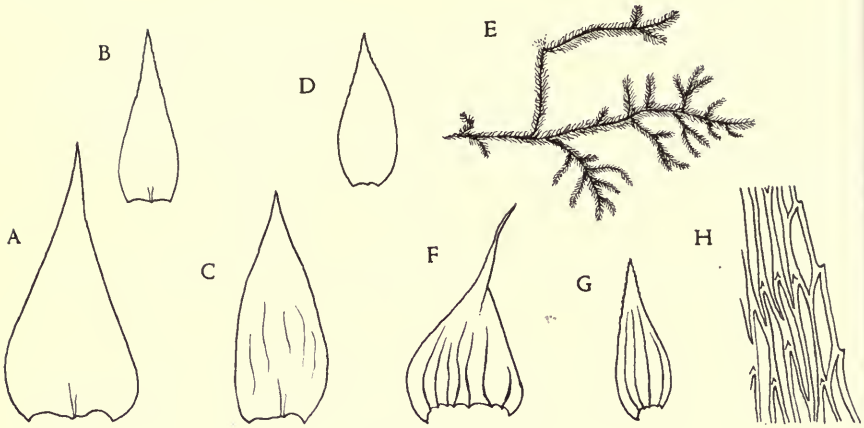

FIGURE 182

A–B, *Mittenothamnium Langsdorffii:* A, stipe leaf, ×16; B, branch leaf, ×16. C–D, *Mittenothamnium pendulinum:* C, stipe leaf, ×16; D, branch leaf, ×16. E–H, *Puiggariella aurifolia:* E, plant, ×1; F, stem leaf, ×16; G, branch leaf, ×16; H, upper leaf cells and margin, ×338.

Distribution: Costa Rica.

On trees and damp banks at medium to high altitudes.

5. MITTENOTHAMNIUM LANGSDORFFII (Hook.) Card., Rev. Bryol. **40**: 21. 1913.

Hypnum Langsdorffii Hook., Kunth Pl. Aequin. **1**: 62. 1822–28.

Autoicous; plants rather robust, yellowish tinged with brown. Stipe leaves 2–2.5 mm. long, gradually acuminate from a broad, often auriculate base, faintly plicate; costa short or lacking; cells linear, shorter and colored across insertion, alar cells lax, oblong, rather numerous. Branch leaves lanceolate, slenderly acuminate, weakly toothed. Seta long; capsule ovoid, subpendulous. (Fig. 182, A–B.)

Dept. San Marcos: *Steyermark 35756.* Dept. Quezaltenango: *Steyermark 34762; Standley 83675.* Dept. Sacatepequez: *Standley 65197, 65277.* Dept. Chimaltenango: *Standley 58763, 60968, 61084, 61109, 80171a.*

Distribution: Costa Rica, South America.

On trees, logs and banks at high altitudes. The distinctions between this species and *M. Lehmannii* are not clear or convincing to my mind.

6. MITTENOTHAMNIUM PENDULINUM (Hampe) Card., Rev. Bryol. **40**: 21. 1913.

Hypnum pendulinum Hampe, Prodr. Bryol. Mex. 109. 1871.

Autoicous; plants with the habit of the preceding species but having the stipe and stem leaves ovate-lanceolate, lightly plicate; costa short; cells linear, shorter and colored across insertion, alar cells oblong, few and inconspicuous. Seta 2–3 cm. long; capsule cernuous, oblong-cylindric. (Fig. 182, C–D.)

Dept. Alta Verapaz: *Standley 91402, 92150.* Dept. San Marcos: *Standley 86207.* Dept. Totonicapan: *Standley 84003.* Dept. Quezaltenango: *Standley 85688, 85930.*

Distribution: Mexico.

On trees and banks at medium to high altitudes.

EXCLUDED SPECIES

MICROTHAMNIUM MICRURUM C. M., Bull. Herb. Boiss. **5**: 215. 1897.

MICROTHAMNIUM TURCKHEIMI C. M., Ibid. 215. 1897.

MICROTHAMNIUM MEGAPELMATUM C. M., Ibid. 215. 1897.

MICROTHAMNIUM SUBPERSPICUUM C. M., Ibid. 216. 1897.

8. PUIGGARIELLA Broth., E. & P. Pflanzenf. **1**[3]: 1046. 1908.

Dioicous; plants moderately robust, golden green, glossy, in lax mats. Stems elongate, creeping or arched, freely branched. Stem leaves widely spreading, strongly plicate, acuminate from a broad, cordate base; costa lacking or short; cells linear, papillose on back at apical angles. Branch leaves narrower, erect-spreading, often slightly secund. Seta to 2 cm. long; capsules nodding; lid long beaked; calyptra pilose. Sporophyte not seen.

1. PUIGGARIELLA AURIFOLIA (Mitt.) Broth., E. & P. Pflanzenf. **1**[3]: 1047. 1908.

Ctenidium aurifolium Mitt., Journ. Linn. Soc. **12**: 509. 1869.

Stems flexuous, to 6 cm. long, branches curved or suberect. Stem leaves 1.5–2 mm. long, 1 mm. wide, rather quickly narrowed to a slender acuminate point from a broad, cordate base, minutely denticulate all around; cells linear, sharply papillose at apical angles

on back, shorter and incrassate across insertion, not or scarcely differentiated at basal angles. Branch leaves narrower, lanceolate, shorter acuminate, more sharply serrulate. (Fig. 182, E–H.)

Dept. Alta Verapaz: *Standley 91604; Steyermark 44449.*

Distribution: Tropical Brazil.

On ground and logs at rather low altitudes. I can find no excuse for separating these collections from *P. aurifolia* with which they agree in all essential particulars. The specimens are especially noteworthy as representing the first record of the genus in North America.

9. RHACOPILOPSIS Ren. & Card., Rev. Bryol. **27**: 47. 1900.

Dioicous; slender plants growing in thin mats. Stems prostrate, irregularly pinnate, complanate-foliate. Leaves in 4 rows; dorsal rows larger, ovate; ventral rows much smaller, narrowly lanceolate, long acuminate; costa faint or lacking; cells narrow, differentiated at basal angles. Seta elongate, smooth; capsules small, subpendulous; lid convex.

1. RHACOPILOPSIS TRINITENSIS (C. M.) E. G. Britt. & Dix., Journ. Bot. **60**: 88. 1922.

Hypnum Trinitense C. M., Syn. **2**: 284. 1851.

Dioicous; plants yellowish green, glossy; stems radiculose, freely branched, to 3 cm. or more long, about 1.5 mm. wide, branches often slenderly attenuate. Leaves dimorphous; dorsal rows widely spreading, asymmetrical, 1 mm. long, ovate, acuminate; margin slightly recurved on one side at extreme base, serrulate above; costa lacking or very short; cells relatively short, linear, alar cells few slightly inflated, hyaline or colored. Ventral leaves much smaller, appressed, about 0.4–0.6 mm. long, narrowly lanceolate, slenderly acuminate. Seta 10–20 mm. long; capsule nodding, urn about 1 mm. long, oblong, contracted to a short neck; lid 0.5 mm. long; peristome teeth brownish, segments from a high basal membrane; spores small, diameter 7–8 μ. (Fig. 183, A–D.)

Dept. Izabal: *Steyermark 39779.*

Distribution: Costa Rica, Panama, Trinidad, British and French Guiana, Angola, Congo, Madagascar.

On bark of tree near sea level. Suggestive of *Isopterygium* to the naked eye but sharply distinct under the microscope in the

dimorphous leaves. The plants vary somewhat in habit and branching as well as in the shape of the leaves but these modifications seem to be of slight importance.

47. HYLOCOMIACEAE

Plants robust; stems often regularly pinnate or bipinnate, usually with abundant paraphyllia. Leaves imbricated or spreading; costa single or double; cells linear, little differentiated at basal angles. Seta elongate, smooth; capsules large, cernuous, urn short; peristome complete.

1. Costa single ..... 1. *Rhytidium*
   Costa double 2
2. Stems twice pinnate, stem leaves acuminate ..... 3. *Hylocomium*
   Stems irregularly branched, stem leaves abruptly apiculate . . 2. *Leptohymenium*

1. RHYTIDIUM (Sull.) Kindb., Laubm. Schwed. u. Norw. 15. 1883.

Hypnum subg. *Rhytidium* Sull., Musc. & Hep. U. S. 75. 1856.

Dioicous; plants robust, golden brown, glossy. Stems without paraphyllia, irregularly branched, attenuate or hooked at tips.

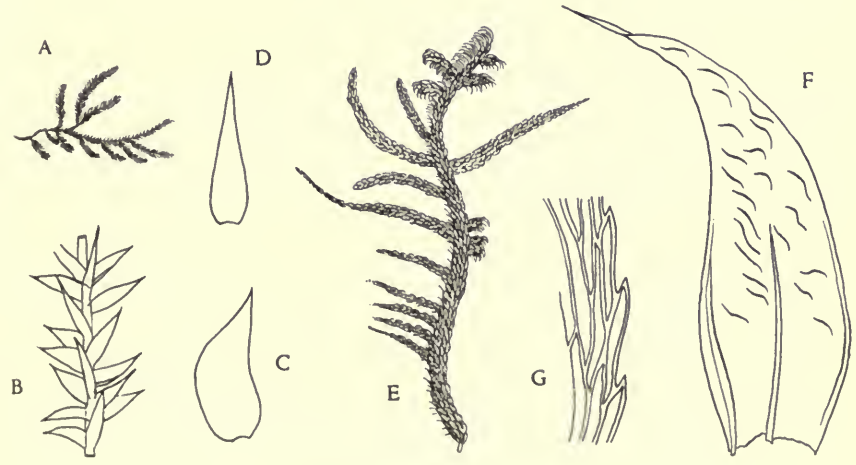

FIGURE 183

A–D, *Rhacopilopsis trinitensis:* A, plant, ×1; B, part of stem, ×10; C, lateral leaf, ×20; D, ventral leaf, ×20.

E–G, *Rhytidium rugosum:* E, plant, ×1; F, stem leaf, ×16; G, upper leaf cells and margin, ×338.

Leaves crowded, often falcate-secund, acuminate, rugose; costa single, ending near mid-leaf. Seta elongate; capsule cernuous.

1. RHYTIDIUM RUGOSUM (Hedw.) Kindb., Laubm. Schwed. u. Norw. 15. 1883.

Hypnum rugosum Hedw., Sp. Musc. 293. 1801.

Plants laxly tufted; stems to 8 or 10 cm. long, suberect. Stem leaves closely imbricated, secund, to 4–5 mm. long, ovate-lanceolate, slenderly acuminate, plicate, strongly rugose; margins narrowly recurved, denticulate above; cells linear, vermicular, strongly papillose at apical angles on back, rounded-quadrate and incrassate in numerous rows at basal angles. Branch leaves smaller, more erect and less rugose. Seta to 5 cm. long; capsule asymmetrical; sporophyte rare. (Fig. 183, E–G.)

Dept. Huehuetenango: *Standley 81174, 83086a, 83088b.*

Distribution: Canada, northern United States, Arizona, New Mexico, Mexico, Europe, Asia, Japan.

On ground in alpine regions. These collections represent the southernmost limit of distribution in North America for this handsome and conspicuous plant.

2. LEPTOHYMENIUM Schwaegr., Suppl. 3, 1, **2**: t. 246. 1828.

Dioicous; moderately robust plants in extensive mats; stems elongate, without paraphyllia, prostrate, irregularly pinnate. Leaves broadly ovate, apiculate, plicate, denticulate above; costa short, double; cells narrowly linear, little differentiated at basal angles. Seta elongate; capsules large, erect, ovoid; sporophyte not seen.

1. LEPTOHYMENIUM EHRENBERGIANUM (C. M.) Fleisch., in sched.

Hypnum Ehrenbergianum C. M., Bot. Zeit. **14**: 408. 1856.

Hylocomium Ehrenbergianum Besch., Prodr. Bryol. Mex. 111. 1871.

Plants yellowish green, slightly glossy; stems prostrate, irregularly pinnate, to 10 cm. long, cuspidate at tips. Stem leaves imbricated or laxly erect-spreading, 2 mm. long, 1.5 mm. wide, broadly ovate, abruptly apiculate, concave, distinctly plicate; margins erect or slightly recurved, serrulate above; costa faint; cells long and narrow, smooth, scarcely differentiated at basal angles. Branch leaves similar but smaller. (Fig. 184.)

Dept. San Marcos: *Standley 68524, 68529, 86445, 86466.* Dept. Quezaltenango: *Standley 85043, 85067.* Dept. Solola: *Steyermark 47464, 47592.* Dept. Guatemala: *Standley 58462, 80724.*

Distribution: Mexico.

On trees and wet banks at high altitudes. These collections differ from the Mexican plants in several particulars. The plants are more robust, the branching laxer and the leaves not decurrent, with the alar cells scarcely enlarged or differentiated. The distinctions are well marked and may indicate a separate species. Unfortunately the plants are consistently sterile. Fleischer places the species in *Leptohymenium*, probably on account of the erect capsules, but Mitten's judgment in including it in *Pleurozium* seems more to the point. It is an interesting problem that deserves closer study.

3. HYLOCOMIUM Bry. Eur. fasc. 49–52. 1852.

Plants robust, rigid, in lax patches or masses. Stems elongate, paraphyllia abundant, branching pinnate or bipinnate. Leaves acuminate from a cordate base; costa double; cells linear, colored across insertion. Seta elongate; capsules cernuous, ovoid; peristome complete.

Stems to 40 cm. long, regularly bipinnate, forming a long, narrow frond
1. *H. giganteum*
Stems to 10 cm. long, irregularly bipinnate.....2. *H. brevirostre*

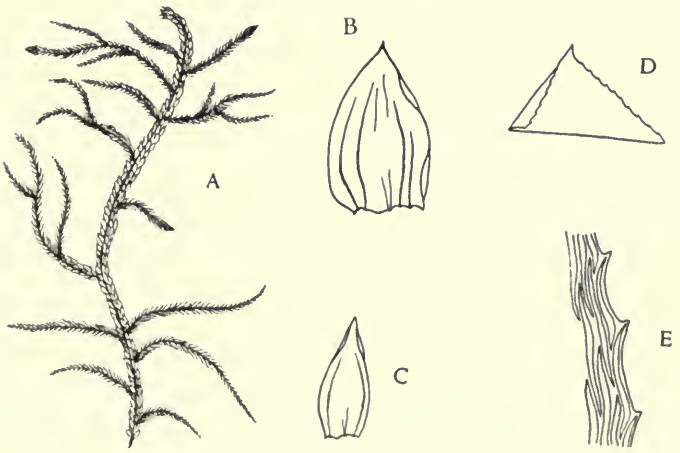

FIGURE 184

Leptohymenium Ehrenbergianum: A, part of plant, ×1; B, stem leaf, ×12; C, branch leaf, ×12; D, apex of stem leaf, ×54; E, upper leaf cells and margin, ×338.

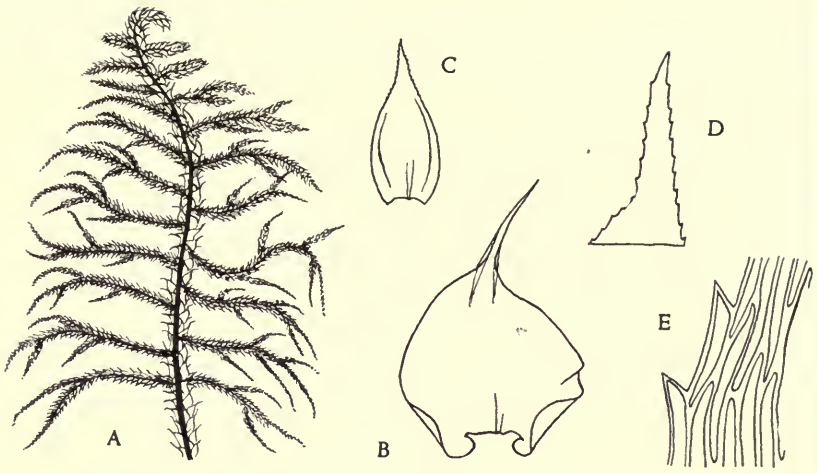

FIGURE 185

Hylocomium giganteum: A, upper part of plant, ×1; B, stem leaf, ×12; C, branch leaf, ×12; D, apex of branch leaf, ×68; E, upper leaf cells and margin, ×338.

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1. HYLOCOMIUM GIGANTEUM Bartr., Bryol. **49**: 124. 1946.

Large, yellowish green, glossy plants. Stems 30–40 cm. long, red, rigid, often simple below, sparsely clothed with slender, branched paraphyllia, bipinnately branched above forming a narrow, elongated frond about 4 cm. wide, branches widely spreading or deflexed, curved and flexuous, 1.5–2 cm. long, attenuate at tips. Stem leaves scariose, well spaced, 3–4 mm. long, 2–2.5 mm. wide, squarrose-spreading from a broadly cordate, strongly clasping base, abruptly narrowed to a slender, channelled acumen; margins plane and entire below, minutely denticulate above, folded inwards at base of acumen; costa short, double; cells narrowly linear, with blunt, rounded ends, laxer, porose and deep brown across insertion. Branch leaves erect-spreading, narrower than the stem leaves and more gradually acuminate, serrulate above; costa longer, often extending to or beyond mid-leaf. Leaves of the ultimate branches ovate-lanceolate, coarsely and sharply serrate above. Sporophyte unknown. (Fig. 185.)

Dept. Totonicapan: Region of Desconsuelo, alt. 3,000–3,240 m., *Standley 62714*. Dept. Chimaltenango: Cerro de Tecpam, region of Santa Elena, alt. 2,400–2,700 m., *Standley 60947*, TYPE.

Endemic.

On trees. This magnificent moss is a striking addition to the tropical American flora. It has some very natural affinities with

H. brevirostre (Ehrh.) Bry. Eur. but the distinctions are quite definite and impressive. In habit, the long stems bipinnately branched above to form a long, narrow frond, it is entirely distinct from any form of *H. brevirostre* I have ever seen. Again the broadly cordate, strongly clasping stem leaves are characteristically different. No fruiting characters are available but it seems highly probable that the Guatemalan plants represent a valid and distinct species.

2. HYLOCOMIUM BREVIROSTRE (P. Beauv.) Bry. Eur., fasc. 49/51. 1852.

Hypnum brevirostre P. Beauv., Prod. 61. 1805.

Robust, glossy plants in dense, deep tufts. Stems to 8 or 10 cm. long, ascending, irregularly bipinnate, clothed with abundant branched paraphyllia, branches widely spreading. Stem leaves squarrose, broadly ovate from a cordate, clasping base, plicate, abruptly narrowed to a ligulate, acuminate point, to 3 mm. long, 2 mm. wide; margins plane, minutely serrulate all around; costa double, short; cells linear, deep brown across insertion and at basal angles, alar cells not differentiated. Leaves of ultimate branches much smaller, erect-spreading, ovate-lanceolate, concave, more strongly serrate. Seta slender, red, to 3 cm. long; capsules horizontal or pendulous, ovoid-cylindrical, slightly asymmetrical; lid 1 mm. long, conical, blunt. (Fig. 178, D.)

Dept. Huehuetenango: *Sharp 5007, 5011.* Dept. Totonicapan: *Sharp 2622.*

Distribution: Nova Scotia to Ontario south to Georgia and Missouri.

On moist slopes and soil in conifer forest at high altitudes. These unusual collections cast some doubt upon the value of *H. giganteum* but comparisons seem to bear out fully the distinctions credited to the newer species. *H. giganteum* is undoubtedly a derivative of *H. brevirostre* yet the difference in size, habit, etc., is so striking that I cannot believe they are conspecific.

48. DIPHYSCIACEAE

Small, gregarious plants. Stems very short. Leaves lingulate, obtusely rounded; costa single; leaf cells small, in two layers. Perichaetial leaves large, aristate, pointed; capsules large, immersed on a very short seta, conical, asymmetrical; peristome double, teeth rudimentary, endostome a pale membrane with 16 longitudinal plaits.

1. DIPHYSCIUM Mohr, Obs. Bot. 34. 1803.

Plants with the characters of the family.

1. DIPHYSCIUM FOLIOSUM (Hedw.) Mohr, Obs. Bot. 34. 1803.

Buxbaumia foliosa Hedw., Sp. Musc. 166. 1801.

Dioicous; plants to 8 mm. high over all, brown, darker below. Leaves crowded, to 2.5 mm. long, contorted when dry, narrowly lingulate from a pale base, broadly rounded at apex, entire; costa ending below apex; upper cells minute, in two layers, very obscure, strongly papillose, basal cells rectangular, incrassate, colorless. Perichaetial leaves forming a conspicuous, pale, penicillate tuft, leaves membranous, gradually narrowed to a long, slender, aristate point formed by the excurrent costa, lamina retuse and fimbriate at apex; capsule nearly sessile, immersed, ovoid-conical, gibbous, narrowed to a small mouth, urn about 3 mm. long, pale; lid conical, 1.5 mm. long. (Fig. 178, E–H.)

Dept. El Quiche: *Sharp 5301.* Dept. Quezaltenango: *Sharp 2197.*

Distribution: Eastern United States south to Alabama, Mexico.

On banks at moderate altitudes. It is instructive to follow the distribution of this species southward through Mexico to Guatemala where it evidently reaches the extreme southern limit of its range.

49. POLYTRICHACEAE

Medium sized to very large terrestrial plants with rigid, erect, simple or sparingly branched stems. Leaves narrow, rigid, from a sheathing base, with parallel longitudinal lamellae on the ventral face. Seta elongate; capsules erect or inclined, cylindrical or angled; peristome single, teeth 32 or 64, solid, not barred; columella bearing a shield-like membrane at top covering the mouth of the capsule; calyptra usually pilose.

1. Calyptra naked or sparsely pilose, leaves bordered with elongated cells ..... 1. *Atrichum*
   Calyptra densely felted with hairs, leaves not bordered 2
2. Capsules terete ..... 2. *Pogonatum*
   Capsules sharply four angled ..... 3. *Polytrichum*

1. ATRICHUM P. Beauv., Prodr. 42. 1805.

Plants medium sized, in loose tufts. Leaves bordered with elongated cells, clasping but not sheathing at base; marginal teeth

single or in pairs; costa narrow, with few lamellae on ventral face. Setae single or clustered; capsules cylindrical, often curved; calyptra cucullate, smooth or slightly pilose at tip.

Lamellae 7–9 cells high, covering ⅓ of lamina at mid-leaf.....1. *A. angustatum*
Lamellae 2–4 cells high, covering ⅙ or less of lamina.....2. *A. Oerstedianum*

1. ATRICHUM ANGUSTATUM (Brid.) Bry. Eur., var. MULLERI (Schimp.) Bartr., Journ. Wash. Acad. Sci. **26**: 15. 1936.

Atrichum Mulleri Schp., Prodr. Bryol. Mex. 62. 1871.

Leaves more strongly contorted than in the typical form of the species, strongly undulate and sharply spinose on margins and back of lamina; lamellae 7–9 cells high, covering about ⅓ of lamina at mid-leaf. (Fig. 186, A–C.)

Dept. Huehuetenango: *Standley 82058*. Dept. San Marcos: *Standley 68909*.

Distribution: Mexico, Honduras, Jamaica.

On shaded damp banks at medium altitudes.

2. ATRICHUM OERSTEDIANUM (C. M.) Mitt., Journ. Linn. Soc. **12**: 605. 1869.

Catharinaea Oerstediana C. M., Syn. **2**: 558. 1851.

?Catharinaea runcinata C. M., Bull. Herb. Boiss. **5**: 176. 1897.

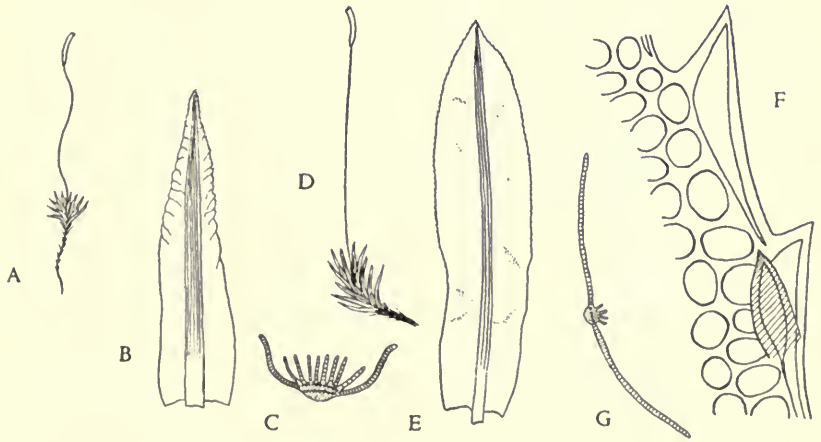

FIGURE 186

A–C, *Atrichum angustatum* var. *Mulleri:* A, plant, ×1; B, leaf, ×10; C, cross section of leaf, ×24.

D–G, *Atrichum Oerstedianum:* D, plant, ×1; E, leaf, ×6; F, upper leaf cells and margin, ×270; G, cross section of leaf, ×24.

Dioicous; stems to 6 cm. high, felted with pale tomentum below. Leaves strongly contorted and crisped when dry, erect-spreading when moist, narrowly lanceolate, acute, about 10 mm. long, 1.5 mm. wide, from a slightly wider base, transversely rugose, doubly serrate nearly to base; costa ending near apex, spinose on back near tip, with 2–4 low, inconspicuous lamellae on ventral face, 2–4 cells high; lamina cells rounded, incrassate, 15–25 μ in diameter, basal cells larger, oblong, more pellucid. Seta single, 2–3 cm. long, red; capsule narrowly cylindric, curved, urn 5–6 mm. long; calyptra unknown. (Fig. 186, D–G.)

Dept. Alta Verapaz: *Standley 90694, 90786.* Dept. Huehuetenango: *Standley 65799, 82419, 82438, 82492.* Dept. San Marcos: *Standley 66215.* Dept. Totonicapan: *Standley 84097.* Dept. Quezaltenango: *Steyermark 33623; Standley 67825, 67828a, 68362.* Dept. Suchitepequez: *Steyermark 46752.* Dept. Chimaltenango: *Standley 64361a, 64472.* Dept. Guatemala: *Standley 58476, 80641, 80649.* Dept. Zacapa: *Steyermark 30013.* Dept. Jalapa: *Steyermark 32486.*

Distribution: Costa Rica.

On shaded banks and logs at moderately high altitudes. Muller described the leaves of *C. runcinata* as scarcely lamellose and the costa as excurrent, but these were no doubt errors of observation.

2. POGONATUM P. Beauv., Prodr. 84. 1805.

Gregarious dull green plants, relatively small to very robust. Stems rigid, leafy above, woody and clothed with scale-like leaves below. Leaves usually contorted when dry, lanceolate from a sheathing base, serrate, rarely entire above; costa dilated upward, usually with numerous longitudinal lamellae on the ventral face, often toothed on back above; basal cells elongate, hyaline. Seta long, smooth; capsules cylindrical, erect or inclined; peristome teeth 32; calyptra densely felted with long, deflexed hairs.

1. Leaf margins entire ..... 3. *P. Carionis*
   Leaf margins serrate 2
2. Marginal cells of lamellae undivided 3
   Marginal cells of lamellae two-parted 5
3. Marginal cells of lamellae papillose ..... 6. *P. alpiniforme*
   Marginal cells of lamellae smooth 4
4. Lamellae 3–4 cells high, leaves short, acute, contorted when dry ... 1. *P. tortile*
   Lamellae 5–7 cells high, leaves long acuminate, rigid .... 2. *P. Liebmannianum*
5. Robust plants, stems to 30 cm. or more high, lamellae 2–4 cells high ..... 5. *P. robustum*
   Small plants, stems to 3–4 cm. high, lamellae 5–7 cells high ... 4. *P. leptopelma*

1. POGONATUM TORTILE P. Beauv., Prodr. 85. 1805.

Stems to 10 cm. high, simple, rigid. Leaves appressed, contorted when dry, 5–6 mm. long, lanceolate from a short, ovate base, acute, serrate about half way down; lamellae numerous, covering nearly all of blade, in cross section showing the terminal cell rounded, slightly larger than the cells below; costa ending just below apex, toothed on back above; basal cells short rectangular, pellucid, smaller toward margins. Seta red, 2–2.5 cm. long; capsule nodding, oblong, urn 3 mm. long, faintly striate. (Fig. 187, A–D.)

Dept. San Marcos: *Steyermark 37424.* Dept. Quezaltenango: *Standley 85148.* Dept. Huehuetenango: *Steyermark 48976.*

Distribution: Mexico, West Indies, Central and South America.

On damp banks at medium to rather high altitudes. Widely distributed in tropical North America and probably with an extensive synonymy. The shorter leaves, contorted when dry, and the lower lamellae separate it from *P. Liebmannianum.*

2. POGONATUM LIEBMANNIANUM (C. M.) Besch., Prodr. Bryol. Mex. 65. 1871.

Polytrichum (*Pogonatum*) *Liebmannianum* Schimp., in C. M., Syn. 2: 563. 1851.

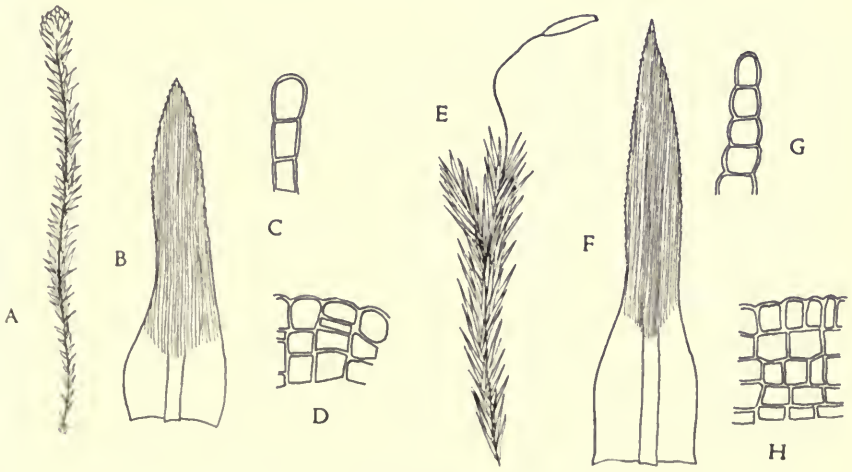

FIGURE 187

A–D, *Pogonatum tortile:* A, plant, ×1; B, leaf, ×10; C, lamella in cross section, ×270; D, lamella, side view, ×270.

E–H, *Pogonatum Liebmannianum:* E, part of plant, ×1; F, leaf, ×6; G, lamella in cross section, ×270; H, lamella, side view, ×270.

Stems 3–10 cm. high, simple or forked above, densely pale tomentose at base. Leaves rigidly erect-spreading when dry, to 10–12 mm. long, lanceolate from an ovate base about 3 mm. long, acuminate, sharply spinose-serrate nearly to shoulders; lamellae numerous, covering nearly all of blade, 5–7 cells high, the terminal cells in cross section rounded and similar to the cells below; costa ending near apex, toothed on back above; basal cells linear, thin walled, hyaline. Seta solitary, 1.5–2 cm. long; capsules nodding, urn cylindrical, smooth, 6–7 mm. long. (Fig. 187, E–H.)

Dept. Alta Verapaz: *Standley 69480, 71531, 71725.* Dept. Huehuetenango: *Standley 65858, 65890, 84336, 85259, 85265.* Dept. Sacatepequez: *Standley 65192.* Dept. Solola: *Steyermark 46961.* Dept. Chimaltenango: *Standley 58702.*

Distribution: Mexico, Costa Rica.

On damp banks at medium to high altitudes.

3. Pogonatum Carionis (C. M.) Par., Ind. Bryol. 979. 1897.

Polytrichum Carionis C. M., Bull. Herb. Boiss. **5**: 177. 1897.

Plants reddish brown; stems to 3 cm. high, simple, upper leaves often crowded in a dense, claviform tuft. Leaves erect, appressed, rigid, 5–6 mm. long, narrowly lanceolate from an oblong or obovate base about 2 mm. long, acuminate; margins inflexed, entire; lamellae covering nearly all of blade, 5–6 cells high, the terminal cell in cross section much larger than the cells below, smooth, transversely oblong, with thick, yellowish walls; costa excurrent in a short, reddish arista; basal cells rectangular, lax and yellowish. Perichaetial leaves 7 mm. long, subulate-acuminate, entire; seta solitary, red, 3 cm. long; capsule nodding, narrowly cylindric, urn 5 mm. long. (Fig. 188, A–D.)

Dept. San Marcos: *Steyermark 35482a.* Dept. Quezaltenango: *Steyermark 34250.* Dept. Chimaltenango: *Standley 58802c.*

Endemic.

On moist ground at medium to high altitudes. Very distinct from all the other local species in the entire leaves and the strongly differentiated end cell of the lamellae.

4. Pogonatum leptopelma (C. M.) Par., Ind. Bryol. 982. 1897.

Polytrichum leptopelma C. M., Bull. Herb. Boiss. **5**: 178. 1897.

Plants reddish brown; stems 3–4 cm. high, simple, upper leaves often crowded in a claviform tuft. Leaves rigidly erect-spreading

when dry, 6–8 mm. long, lanceolate from an ovate base about 2 mm. long, acute, spinose at apex, serrate more than half way down; lamellae covering nearly all of blade, 5–7 cells high, the terminal cell in cross section divided into 2 forks; costa ending below apex, spinose on back at tip; basal cells narrowly rectangular, hyaline or yellowish. Seta about 1.5 cm. long, red, flexuous; capsule suberect, cylindrical, urn 3–3.5 mm. long, constricted below mouth. (Fig. 188, E–H.)

Dept. Huehuetenango: *Standley 82492a.* Dept. San Marcos: *Steyermark 35657a; Standley 85421.* Dept. Totonicapan: *Standley 62700* (as *P. Bernoullii*), *62706* (as *P. Bernoullii*), *84434, 84467.* Dept. Quezaltenango: *Standley 86125a.* Dept. Chimaltenango: *Standley 58803.* Dept. Zacapa: *Steyermark 42861.* Dept. Chiquimula: *Steyermark 30976.* Dept. Jalapa: *Steyermark 32623, 32629.*

Endemic.

On damp banks and rocks at medium to high altitudes. This appears to be a small edition of *P. robustum* without any sharply distinctive characters.

5. POGONATUM ROBUSTUM Mitt., Journ. Linn. Soc. **12**: 616. 1869.

Pogonatum robustum Schimp., Prodr. Bryol. Mex. 66. 1871.

?Polytrichum volvatum C. M., Bull. Herb. Boiss. **5**: 177. 1897.

?Polytrichum Bernoullii C. M., Ibid. 178. 1897.

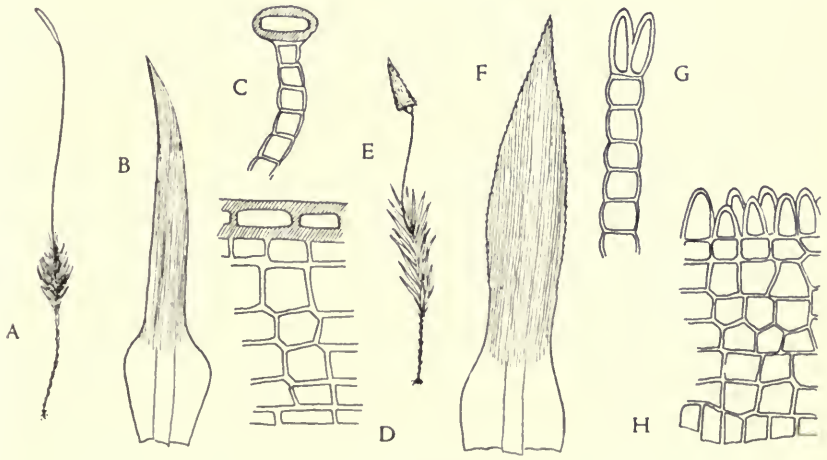

FIGURE 188

A–D, *Pogonatum Carionis:* A, plant, ×1; B, leaf, ×10; C, lamella in cross section, ×270; D, lamella, side view, ×270.

E–H, *Pogonatum leptopelma:* E, plant, ×1; F, leaf, ×10; G, lamella in cross section, ×270; H, lamella, side view, ×270.

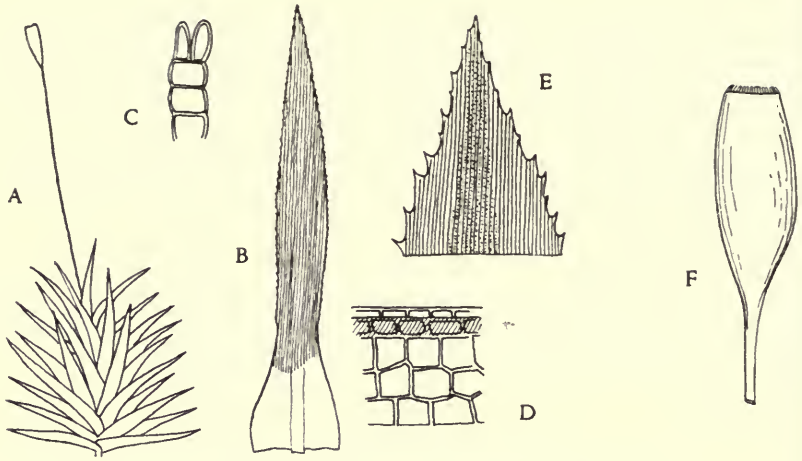

FIGURE 189

Pogonatum robustum: A, upper part of plant, ×1; B, leaf, ×6; C, lamella in cross section, ×270; D, lamella, side view, ×270; E, apex of leaf, ×270; F, capsule, ×4.

Plants robust, brownish green. Stems to 25 or 30 cm. high but often shorter. Leaves crowded, to 15 mm. long, often flexuous-spreading when dry, linear-lanceolate from a short ovate base about 2 mm. long, acute, spinose-serrate nearly to shoulders; lamellae covering nearly all of blade, 2–4 cells high, the terminal cells in cross section divided into 2 forks; costa ending near apex, toothed on back above; basal cells narrowly rectangular, pellucid. Seta red, 1.5–3 cm. long, flexuous; capsule suberect, urn cylindrical, 4–5 mm. long. (Fig. 189.)

Dept. Alta Verapaz: *Standley 90330.* Dept. San Marcos: *Steyermark 36007, 36441, 36968; Standley 68506, 86473.* Dept. Totonicapan: *Standley 62696, 62703, 62711, 62733, 84009* (as *P. Liebmannianum*). Dept. Quezaltenango: *Steyermark 34871.* Dept. El Progresso: *Steyermark 43543.* Dept. Zacapa: *Steyermark 42542.* Dept. Chiquimula: *Steyermark 31055.* Dept. Jalapa: *Steyermark 32465.*

Distribution: Mexico, Costa Rica, Panama, Jamaica.

On banks at medium to high altitudes. It is possible that the very robust plants with longer leaves and lower lamellae grow in localities where there is an abundant and constant supply of moisture and conversely the plants with shorter stems, more crowded, erect leaves and higher lamellae are adapted to a drier habitat where the conservation of moisture is more imperative. I suspect that *P. volvatum* and *P. Bernoullii* are forms belonging in the latter group which seem to grade imperceptibly into *P. leptopelma.*

6. POGONATUM ALPINIFORME (Card.) Bartr., Bryol. **49**: 125. 1946.

Polytrichum alpiniforme Card., Rev. Bryol. **37**: 6. 1910.

Plants brownish green, paler at tips, laxly tufted. Stems 4–20 cm. long, simple or sparingly branched, usually denuded of leaves below. Leaves crowded, 8–12 mm. long, erect or flexuous when dry, linear-lanceolate from a sheathing base, acuminate; margins serrate; lamellae numerous, 5–7 cells high, crenulate and papillose on the free edge when viewed laterally, the terminal cells in cross section conical, thick walled, papillose; costa excurrent, toothed on back above; basal cells narrowly rectangular. "Seta about 2 cm. long; capsule minute, oblong; calyptra 6–7 mm. long, sparsely pilose." Sporophyte not seen. (Fig. 190, A–D.)

Dept. San Marcos: *Steyermark 35545, 36104a, 36158.* Dept. Quezaltenango: *Standley 67710b, 67685, 67727.* Dept. Solola: *Steyermark 47502.*

Distribution: Mexico.

On banks and exposed rocky slopes at high altitudes. Apart from the crenulated edges of the lamellae there is absolutely nothing distinctive in these plants as compared with *P. alpinum* (Hedw.) Roehl. Most of the plants I have examined show this character quite clearly but in some of the collections, especially No. 36158, the free edge of the lamellae is nearly entire. *P. alpiniforme* is evidently closely allied to *P. alpinum* and may have to be combined with it eventually. The sporophyte characters are taken from Thériot's description (Smiths. Misc. Coll. **85**[4]: 44. 1931).

3. POLYTRICHUM Hedw., Sp. Musc. 88. 1801.

Dioicous; plants erect, rigid, green, tinged with brown. Stems leafy above, gradually grading into the scale-like bracts below, tomentose in lower parts. Leaves erect or spreading, lanceolate from a sheathing base, entire or toothed above, with numerous longitudinal lamellae on ventral face; costa dilated upward, often excurrent in an awn. Seta elongate, solitary; capsules sharply 4–6 angled; peristome teeth 64; calyptra densely felted with deflexed hairs.

1. POLYTRICHUM JUNIPERINUM Hedw., Sp. Musc. 89. 1801.

?Polytrichum angustifolium Schimp., Bull. Herb. Boiss. **5**: 178. 1897.

Plants usually closely gregarious, yellowish or glaucous green at tips, brown below. Stems angled, to 15 cm. or more high, usually

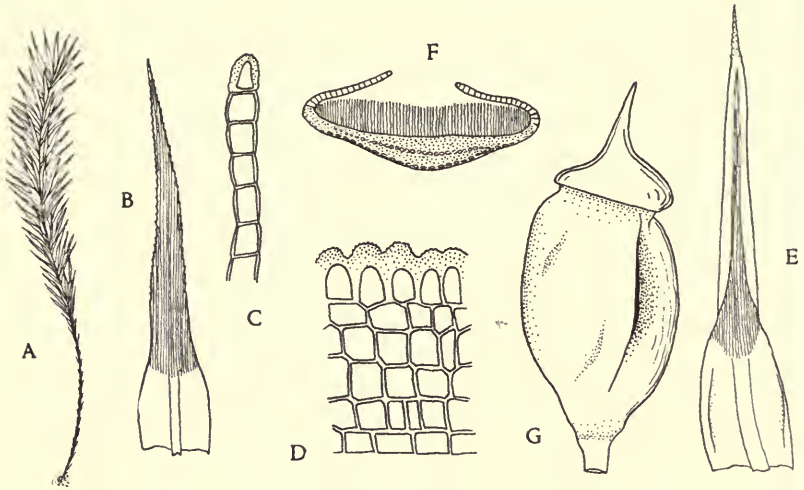

FIGURE 190

A–D, *Pogonatum alpiniforme:* A, plant, ×1; B, leaf, ×6; C, lamella in cross section, ×270; D, lamella, side view, ×270.

E–G, *Polytrichum juniperinum:* E, leaf, ×6; F, cross section of leaf, ×54; G, capsule, ×8.

simple. Leaves 8–12 mm. long, narrowly lanceolate from an erect, sheathing base, ending in a reddish, denticulate, aristate point; lamellae 4–8 cells high, the end cell in cross section conical, thick walled; margins entire, broadly inflexed above shoulders; costa excurrent, toothed on back above. Seta to 5 cm. long or longer, red; capsule nodding, oblong, urn 4–5 mm. long, sharply 4 angled; calyptra pale brown, covering capsule. (Fig. 190, E–G.)

Dept. Alta Verapaz: *Standley 71049.* Dept. Huehuetenango: *Standley 81436, 81665, 81671, 82123, 82492b.* Dept. San Marcos: *Standley 66228, 66250, 71138, 71203.* Dept. Totonicapan: *Standley 84528.* Dept. Quezaltenango: *Standley 67414, 67419, 67421, 67426a, 67828b, 67835, 83642, 83854, 84580; Steyermark 34621.* Dept. Sacatepequez: *Standley 58861, 59454, 60748, 60780, 81001.* Dept. Solola: *Standley 62744.* Dept. Chimaltenango: *Standley 80256.* Dept. El Progresso: *Steyermark 43109.* Dept. Chiquimula: *Steyermark 31054.*

Distribution: Arctic North America, Canada, United States, Mexico, Central America, West Indies, Europe, Asia, Africa, Oceanica.

On soil at medium to high altitudes. Very variable in size and habit depending upon the environment. There seems to be no good reason for continuing *P. antillarum* Rich., at least as far as the Central American plants are concerned. I can find no stable characters by which it can be separated from *P. juniperinum.*

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